NATIONAL LIBRARY OF MEDICINE

JOHN SHAW BILLINGS CENTENNIAL

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Addresses Presented

June 17, 1965

In Commemoration of the 100th Anniversary of

Dr. Billings' Appointment to Head the

Library of the Surgeon General's Office,

U.S. Army

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Bethesda, Maryland, 1965

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INTRODUCTION

In 1865 the office library of the Surgeon General, U.S. Army, was placed under the care of Dr. John Shaw Billings. During the 30 years that he devoted to this institution, Billings created a great national medical library, now the National Library of Medicine. In commemoration of his achievements, which are described in the following pages, the Library held a Centennial celebration on June 17, 1965.

The program was divided into two parts: an afternoon session in which the current challenges facing medical libraries were explored; and an evening session, in which the contributions of John Shaw Billings to medicine and to librarianship were described.

The Library is pleased to make available to a wider audience in this form the papers presented at this Centennial celebration.

Martin M. Cummings, M.D.
Director
National Library of Medicine

Medical Libraries and Medical Research

By The Honorable John E. Fogarty
United States Representative, Rhode Island

We are here today to honor an individual whose great life and work helped materially in diverse ways to organize and advance the cause of medicine. The debt to Dr. John Shaw Billings is not a debt only of physicians and others in the health sciences. It is a debt of the entire nation. Dr. Billings' achievements in helping to consolidate and focus the progress of medicine through its literature have benefited the lives of all of us, even today, 100 years later.

It is most proper for us to recognize also that it was Dr. Billings who, through the National Board of Health, actually made the first Federal grants for medical research. In the 1880 Annual Report (1) of the Board, Dr. Billings, in his capacity as Vice President, wrote to the Honorable John Sherman, Secretary of the Treasury, to which the Board was answerable. He spoke of the importance of medical research and cited the commendable work of the British government in supporting such research. His report pointed out that the costs of research exceeded the funds available to private investigators and emphasized that the assistance of the Federal government was therefore necessary. This sounds like 1965.

His report then lists the types of projects the National Board of Health was supporting. These included--

studies of the air, a forerunner to our present air pollution research;

studies of the adulterations of food and drugs, matters about which we are still concerned;

sanitation;

yellow fever;

disinfectants;

diphtheria; and still other fields.

I have been extremely pleased to learn that my own state of Rhode Island was included in the research work financed by the old National Board of Health under Dr. Billings' direction. The annual report of the Board of 1882--83 years ago--contains a report of inspections of health resorts and under that a "Report on Sanitary Condition of Newport, R.I." It is a very fascinating document including many maps, drawings and illustrations. Beyond the question of sanitation the report is concerned with the city's water supply; and I believe the remarkable farsightedness of Dr. Billings is illustrated by the fact that the report contains extensive information on different types of analyses carried out on the water.

I am happy to say that the report about Newport was a very good one and I will illustrate this if I may by reading the first sentence of the report: "Newport has always been considered, and unquestionably is, naturally, an exceptionally healthy place." (2) Naturally, I believe it still is!

From this particular locale here today it is easy to see and feel the importance of Dr. Billings' work, in the dignity, power and significance we in America have given to medicine, and which in turn is serving to give us healthier, longer, more productive and happier lives. We stand in the world's greatest medical library. Next door to our north is the world's finest medical research organization. Across the street is the great National Naval Medical Center, and only a short distance from here is the Walter Reed Army Medical Center and the Armed Forces Institute of Pathology.

If there were a pinnacle of the world of medicine at which we could stand, this would be it.

It is a world as yet unfinished, however. We have not defeated disease, disability, birth defects, and premature death. These problems continue to challenge us to the limit of our abilities. At the same time, we seem to have achieved, at long last, the opportunity at least for almost total victory. It would seem to be within our grasp to attain an entirely new level of mental and physical health for mankind and perhaps witness the eradication of disease entirely.

We are living in the midst of dramatic and far-reaching changes in the concepts of biomedical research, with the employment of new knowledge, new techniques, new ideas, new instrumentation, and, indeed, new types of personnel, such as

mathematicians and physicists. The influence and effects of the biomedical research effort are becoming wider and its character is changing. There is ample evidence that the biomedical achievements of the near future may be dramatically more significant than any in the past. I have in mind particularly a new spectrum of work in human reproduction and human development; molecular biology and genetics and the new light they promise to throw on work in many other biomedical disciplines; and the extensive work in viruses, in relation to cancer and other diseases. In recent testimony before Congress, Dr. James A. Shannon, the Director of the National Institutes of Health, pointed to new progress in understanding the relationship between psychology and physiology. He said: "The line between the medical sciences and the behavioral sciences is disappearing." This is as it should be.

In this place, on this day, at this particular point in history, it is difficult to avoid a sense of happy anticipation about the new hope being offered us by the health sciences; and it is proper that we again recognize Dr. Billings' work in having begun this great institution, this library, where this new knowledge resides for man's present and future use.

However, let me read something to you: "Unless major attention is directed to improvement of our national medical library base, the continued and accelerated generation of scientific knowledge will become increasingly an exercise in futility." (3) The statement is from a section headed Communications for Research, from Volume I of the report by the President's Commission on Heart Disease, Cancer and Stroke.

Let us consider carefully what this statement means. It is saying that the great potential benefits of medical research which I have just been talking about may not be improving the health of our nation as they might. It indicates that the financial, human, and institutional investments we are pouring into research, to bring about better health for the American people, may be wasted or lost for the want of better facilities and methods to house, manage, and disseminate the medical literature.

This is indeed a curious commentary on the nation that leads the world in its concern for health and medicine, and it could be a tragic commentary if the vast sums the Federal government spends for medical research, education, and practice were being rendered less effective because we are not willing to spend a few more dollars, relatively, for the medical libraries which serve as the communication centers for health science information.

Just how much money are we talking about?

If we talk only of research, the Federal government is spending well over one billion dollars, and private sources are spending another 600 million or 700 million dollars. Last year, out of the one billion dollars provided in Federal funds, less than one million, under present legislative authorities, could accrue to the benefit of the nongovernment medical libraries. That's about one-tenth of one percent. If we try to make a comparison to the total budget of the Department of Health, Education, and Welfare, of five and one-half billion dollars, the comparison becomes even more ridiculous. The Federal government is simply not paying its share of the nation's costs for medical communications, even though it has helped to intensify the problem by its emphasis on, and support of, medical research.

We must remember that the medical libraries, as the prime storehouses and distributors of health science information, are feeling the pressures of all of our national activities in relation to health and medicine, both private and public. All of the tremendous increases in health and medical activities have an impact on the medical libraries. All research papers, journals, pamphlets, reports, conference proceedings, handbooks--nearly every printed document, in fact, which grows out of our concern for man's health, becomes something the medical libraries must acquire, store, and disseminate to those who need the information. Then these massive health activities generate greater demands on the medical libraries for services.

As a measure of these demands, let us take due notice of the fact that all public and private health and medical expenditures in the nation today total more than 35 billion dollars.

If this is a measure of our health concerns, we have failed very seriously--I hope not irreparably--to recognize and attend to fundamental requirements for medical information and particularly medical libraries.

My special concern here today is for the medical libraries in relation to the promise held for us in medical research. Medical research is impossible without an adequate information base, without the resources and services of medical libraries. It has been said--and I believe this must be true--that all medical research begins and ends with the medical literature. If this is

so true, then why are we jeopardizing our own purpose by scrimping when it comes to giving the medical scientist the library tools he needs?

Sir William Osler, who was a close friend of Dr. Billings, once said: "To study the phenomena of disease without books is to sail an uncharted sea, while to study books without patients is not to go to sea at all." (4) My friends in medicine tell me that this applies today as it did at the turn of the century.

The literature constitutes an integral part of the process of studying human biology and human disease. To limit its usefulness is to limit the scientist and to limit man's chance for the new level of health I talked about earlier.

Today it clearly is not enough to say that medical scientists need information. The real question, instead, is just how do we meet their information requirements? We long ago recognized--or we should have recognized--that the production of books and journals was not enough and that putting these books and journals in libraries was not enough. Dr. Billings saw this 86 years ago. He instituted control and access to the literature by producing the first comprehensive index to current medical periodicals in 1879. This has been acknowledged by many to be America's greatest contribution to medicine in the 19th century.

But the quantity of the literature for some years has so overwhelmed all of our information-handling concepts as to render them obsolete. The worldwide production of biomedical literature is now estimated at more than 250,000 articles or five million pages per year. That many pages would constitute a stack higher than the Empire State Building. It obviously is of no help to the medical scientist to expose him to five million pages of literature in a year's time or a half-million pages or even 100,000 pages, unless you want him to do nothing but read the literature; and that is not what we want him to do. In fact, it would be impossible for him to read it in the time available. We want him to fulfill to the most effective level possible his capacities and opportunities for research, and if he is to do this, his own effort to acquire information must be among the less time consuming of his concerns. He must have ready access to those parts of the literature relevant and pertinent to his scientific pursuits.

The problem is not new. Dr. Vannever Bush in 1944 said: "The summation of human experience is being expanded at a prodigious rate, but the means we use for threading through the

consequent maze to the momentarily important item is the same as was used in the days of square rigged ships--the modern great library is not generally consulted; it is just nibbled at by a few." (5) Libraries must be made more attractive and more functional so that bigger bites of information are taken by those who need it.

The quantity of the literature, however, is not the only problem. Our achievements have been such that the whole character of biomedical research has changed and out of this change has come a transformation in the structure of the health sciences. The usual classification of the sciences--necessary for their organization in teaching and research--has been outmoded. The divisions between disciplines have faded and new disciplines have been formed. Some, as we have noted earlier, have been found to have significance in nearly all other biomedical disciplines.

In 1962, Dr. Robert R. Wagner had this to say: "In the future, organization of basic science departments as separate disciplines will lose all validity. This eventuality is a natural concomitant of the centralization of biological thought. Even today, a visitor to a medical school can distinguish one department from another only by the lettering on the office doors of the department chairmen." (6)

So the problem of the scientist is not only one of tremendous magnitude in the literature but also one in which the disciplinary guidelines have ceased to have their former meaning. The complex interrelationships of the vast amount of data with which he is confronted may be such as to keep him from knowing just where to look; and certainly these two situations of quantity and complexity conspire not only to consume the time which he should be spending at his bench, but possibly also to bring confusion and frustration into his efforts. Physicians and scientists need information specialists to help them in the same way they need and use laboratory assistants and co-workers. We must begin to train these new types of librarians in abundance, and as soon as possible.

Also we need research in the field of information science. In 1960, Dr. Don R. Swanson said: "The sheer abundance of recorded knowledge and the growth rate thereof seems to foreshadow a crisis in inundation. The implied death of scientific information might be forestalled by engineering breakthroughs, but such breakthroughs may depend on first acquiring a deeper understanding of the conceptual nature of the problem itself." (7)

Before we can develop the systems and mechanisms to provide information to the scientist--even before we can conduct truly effective research in this area--we must know what information the scientist must have.

And he very well may not know what it is he wants. Since 70 percent of the medical literature is published in foreign languages, he may not be aware of what is going on elsewhere.

He is not expected to be an information expert; and as a man whose life is devoted to uncovering new knowledge, he cannot be expected to anticipate fully and accurately, if at all, what information he is going to need to relate to his work on a day-to-day or week-to-week basis. However, he should have quick access to all information when he is able to identify his needs.

During World War II there used to be jokes about high ranking military officers in the Pentagon pounding their desks and saying: "I don't know what it is I want, but I know I am not getting it." The biomedical scientists of the nation today strike me as individuals who can honestly and justifiably cry out in this manner.

The National Library of Medicine has begun to meet this urgent need through the use of computers. MEDLARS (Medical Literature Analysis and Retrieval System) provides a fast method of recovering bibliographic citations in any medical discipline or any combination of disciplines. However, MEDLARS' tremendous searching power has not yet been decentralized across the nation as it must be soon. It is the only system of its type in the world and its establishment in a research library is a spectacular achievement.

Still we must learn more about the scientist's habits of using information and his requirements for urgency, variety, and volume. We must know his needs for secondary publication forms, such as indexes, abstracts, data compendia, critical reviews. These are library functions and they need to be supported considerably beyond the current level.

These studies necessarily must be related to concurrent studies in medical terminology and classification, machine indexing, and new techniques, systems, and equipment for processing, storing, retrieving, and distributing health science information.

In addition, the whole scheme of biomedical librarianship as it is now practiced must be studied and re-evaluated--the object being to meet fully the users' needs.

We must immediately begin to develop medical libraries with a new concept of service responsibilities to the medical scientist. These libraries must have the flexibility and versatility to be active--not passive--partners in the research process. They must be staffed with people of imagination, advanced training, and special skills necessary to assist the research scientist in every possible way. Certainly these libraries must have the resources in books, journals, equipment, and people necessary for them to fulfill their missions.

Just two months ago Volume II of the report by the President's Commission on Heart Disease, Cancer and Stroke was released. It contains a section entitled "A Program for Developing Medical Libraries." It was prepared by the Subcommittee on Facilities of the Commission and it tells a truly alarming story of the state of disrepair of the nation's medical libraries. I think I should state frankly that we, the American people, have permitted this unfortunate condition to develop.

Let me read from one part of the report: "The cutting edge of the country's medical research programs may be blunted by the growing inability of scientists to gain quick and easy access to biomedical data they need. Teachers and students are hampered in their educational pursuits. Of direct and immediate importance to the health of the nation are urgent needs of medical practitioners of all types for more ready access to the growing body of new medical information. Inefficiency in the medical library network creates an insidious ignorance which neither science nor the practice of medicine can condone. It results in the unplanned and unnecessary duplication of research efforts. It postpones the application of new knowledge potentially important to the alleviation of human suffering." (8)

It is very difficult for me indeed to think of a more serious charge against this nation.

The report goes on to present hard facts and statistics on medical library needs. Let me cite some of these. For example, there are 6,000 medical libraries in the United States, but only 3,000 medical librarians--one-half of a librarian for every library. The needs for additional space, so that the libraries can be of a size sufficient to meet minimal standards, total into the

millions of square feet. The requirements for books and journals total into the millions. And in the area of training, despite the tremendous deficit in the number of librarians, only 40 additional professional librarians are being added to the field of medicine every year--while the attrition is 150.

The situation is truly desperate.

So this is our challenge. What is to be done about it?

There is before Congress at this time a bill which would establish the legislative and program foundations for this work. I refer of course to the "Medical Library Assistance Act of 1965." This bill constitutes formal recognition for the first time in this nation's history of what have been our failings in the medical information field and of what we must now do to correct our past errors.

I have been tremendously impressed by the reactions of just about all elements of the library and biomedical community to this bill. I will not go into a great amount of detail but I would like to name for you some of the organizations which have formally expressed their wholehearted support of the proposed measure. These include: The American Heart Association, American Dental Association, The American Hospital Association, The American Psychiatric Association, The American College of Physicians, The American Federation for Clinical Research, The Association of American Medical Colleges, The American Society for Biological Chemists, The American Thoracic Society, The New York Academy of Medicine, and others.

Notice that none of these organizations is a library organization.

But in addition, of course, there have been formal indications of very strong support by the Medical Library Association, by the Special Libraries Association and by the Association of Research Libraries.

I can think of few legislative measures which have resulted in such a strong, concerted reaction of support from such a broad segment of the American health science community.

As I have become more and more familiar, as a layman, with the medical information problem, I have become more convinced that the establishment of an extramural program for the National

Library of Medicine is essential and urgent. Also I wonder if the nation should not take further advantage of the great skill and power of this institution and establish within the National Library of Medicine a National Center of Biomedical Communications. This Center, as a carefully coordinated division of the Library, would serve to carry out a number of service activities beyond those presently possible for the National Library of Medicine. I have in mind, for example, the need for improved approaches to the production of abstracts and the coordination of abstracting activities. I have also in mind the fact that the needs for MEDLARS services, and the development of new and advanced MEDLARS systems, will exceed the present capacities of the Library. Beyond these additional service activities, a National Center of Biomedical Communications would be closely and continuously concerned with research and development in the biomedical communications field. As I have tried to indicate in this talk, additional new informational activities are critical to the continued advancement of biomedical research, but, at the same time, we need a great amount of research in the communications and information processes themselves. This Center would become a national focal point for such work. A complex of regional medical libraries, under NLM's guidance, would be an essential part of this picture. My concern here of course is not to heap further honor on this fine institution, so much as it is to see to it that the nation makes maximum use of every possible resource to help meet the needs for medical information.

Let us make no mistake about what our real mission is. It is the realization of the unprecedented research achievements held in the balance for us at this moment in history. It is the fulfillment of great promises for better health and longer lives for the American people.

Great societies of the past invented libraries to preserve and transmit knowledge. If we are to achieve in this nation a society of the greatness I consider possible, we must begin immediately not to reinvent the library but to capitalize on this achievement and to fashion it to these medical research and other needs which have overtaken us in recent years. The challenge before us cannot be met by legislation alone, or by the National Library of Medicine alone, or by the private sector of the economy alone. The challenge calls for a wholehearted cooperative effort by everyone concerned. What Dr. Billings started in 1865 must be further supported in 1965. The future well-being of this nation depends on it.

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Medical Libraries and Medical Education

By The Honorable Oren Harris
United States Representative, Arkansas

I can think of no occasion in which I am happier to participate than this Centennial to honor Dr. John Shaw Billings who founded this Library. Dr. Billings achieved international fame as a librarian, physician, bibliographer, statistician, educator, hospital planner, and sanitarian. But above all, perhaps, Dr. Billings was an inspired educator. And so much of his life was devoted to medicine that I think that if he could be with us today he might prefer that we talk about medicine rather than only about his accomplishments.

When we look at the role of medicine in this nation today we find that it is difficult to examine this field in historical perspective without frequent mention of Dr. Billings' name, and particularly in the fundamental area of medical education. By providing students, scholars, and researchers with the key to the stored knowledge of the medical profession, he did as much for medical education as he did for any other area of medicine--and none is more important than education.

Plato said: "The direction in which education starts a man will determine his future life." (1) This is certainly true of medicine and of all the health sciences. The things young medical students learn in their formal educational courses in medicine set the directions of their future lives as physicians and scientists. The character of their instruction more often than not determines the quality and productivity of their future work. At no point do we have a better opportunity to shape the character and skill of medical scientists, so important to the well-being of the country, than we do at the formal educational level in the years of medical school, internship, and post-graduate training.

The very purpose of education is the transmission to another generation of skills, knowledge, and information; and there can be little debate that a most important tool in this process, certainly in medicine, is the literature. There are other formal

*Mr. Harris' speech was delivered for him by the Honorable Leo W. O'Brien, United States Representative, New York.

communication processes, or media, such as conferences and meetings, to name two; but they begin and end with the published literature.

Today, the medical literature and our educational mechanisms are feeling the impact of what is referred to as the information explosion. It goes along with the population explosion.

As our populations multiply, we face the ever-expanding task of educating larger and larger numbers of people, and therefore the population explosion steps up the urgency for developing adequate educational programs so that great masses of humanity--and particular scientific groups--can be informed in the quickest possible time. Perhaps we can never expect the great surge of new information to be disseminated equally among our population, because human capabilities and ambitions will always affect what an individual can grasp and retain, even aside from his learning opportunity. However, it would be ironic indeed if, in this age of science and technology with its mushrooming spread of new knowledge and information, we should allow much of the information to slip from our hands and be lost to posterity simply because our libraries are unable to devise a means of properly recording, sorting, storing, and disseminating it.

History records that early man had only the most limited means of storing information and passing it along to succeeding generations. We see evidence of this today in discoveries from early cultures, such as picture stories or recordings on the walls of caves, on stone blocks, or clay plates. Historians tell us that the Bible was transmitted orally and through memory for many years, and in fact in some areas this custom of relying on memory to transmit information still prevails today. I might add that where this practice still prevails, you also will find the most underdeveloped cultures in the world in which we live.

The advent of the printing press opened up a whole new approach in educational and informational techniques. With modern communication activities added to that, there is today almost no limit to what we can peruse if we have the time and inclination to do so.

The future of this nation, and all nations, will be influenced by science; and where medicine is concerned, I can think of no single facility more important than the medical library in turning the information explosion to our advantage.

A hundred years ago, medicine was taught very largely by preceptors. Each student served an apprenticeship where he learned the practical aspects of medical care. There was little science in medicine at the time and emphasis was placed, quite properly, on the art of medicine. Then, fifty years ago, a medical school became a place to learn all about medicine, and teachers attempted to convey all pertinent information to the student through lectures, books, and laboratory and bedside teaching. Today, medicine is a science as well as an art; and teachers of medicine realize, and candidly admit, that a medical school cannot teach all of medical knowledge to anyone. Instead, emphasis is placed on the principles of medical science and specifically on the scientific method. Students, particularly medical students, must be gently influenced towards the cultivation of scholarly as well as scientific attitudes. The student must learn to learn as well as learn to be taught. The library is fundamental to both of these educational processes.

Without the ready availability of current information such as that in books and journals, medical education can be hampered and left years behind the times. It is part of the student's education to learn to use these materials, to keep abreast of the rapidly changing developments in the field of medicine. Both in the clinical care of patients and in his early endeavors in research, the medical student is referred to the current medical literature to supplement his lectures and bedside instruction. It is imperative therefore that this current information be readily available to the medical student. To this end the medical library has a central, indispensable role to play in medical education.

Because the dictum "What is research today, will be practice tomorrow" is so often the case, it is necessary that the medical student and house officer have every possible opportunity to refer to current medical publications. It is inconceivable that any one individual in training can personally subscribe to all the medical journals having information of importance to his courses of instruction. There must therefore be well equipped and well staffed medical libraries at the disposal of such individuals.

The tasks of recording new knowledge in textbook form for classroom or study use, and of integrating this new information into the curriculum of medical schools, is necessarily a time-consuming process. But where delay must be attributed to inadequate libraries, it does not strike me as a delay which is

justifiable or excusable; because libraries are something about which we can, and must, take constructive action.

It is important to realize that a large number of interns and residents are trained at private and community hospitals with no convenient access to the local medical school or county medical library. These private and community hospital libraries thus are the only source of vital information needed immediately in daily patient care as well as for reading to keep up to date. Most private and community hospital libraries are understaffed, have a limited budget, and generally offer at best a limited collection of textbooks and journals. The underprivileged state of such libraries is a source of continuing frustration for the house staff of such institutions. Again, this is a situation which can and must be remedied.

With our continued emphasis on research, we may well be on the verge of doubling, even tripling, our knowledge of the biomedical sciences in the next generation. If we allow research to continue to outdistance our ability to document it and transmit it both to the student and to the practicing physician, we are not only wasting a precious resource, we are threatening the health of the nation. This new knowledge, in the hands of faculty and students, is a spur to further research, and in the hands of the practicing physician it can actually help him save lives.

Knowledge of disease has become so extensive that it is impossible for the clinical teacher to present to the medical student--the physician of tomorrow--all that is known about diagnosis and treatment. The learning tools available to the student are the classroom lecture, the faculty-supervised bedside orientation, the laboratory, and the library. In fact, the library is the primary learning resource of every university.

If, during his student days, the physician of tomorrow has at his disposal a good collection of books and journals, adequately housed so they are easy to use, and staffed with librarians and science information specialists who are skilled in helping him choose and select, he has only himself to blame if he does not take advantage of the tools available to him. On the other hand, if we fail to provide him with these tools, we are failing not only him but his patient also, who might easily be you--or me.

So extensively is new knowledge being accumulated that teaching faculties face the increasing problem of first screening or

sifting the material available to determine what is new or pertinent. The actual reading or absorption of the material is now a second step!

In other words, we have passed the day when a faculty member--who must divide his time between preparation of lectures, laboratory and clinical work, and counseling of students--can hope to read everything being added to the archives of medical science. He simply does not have the time. About the best he can do is to look for summaries or digests of pertinent material and hope that he has not overlooked something important.

Thus, we face the challenge of assisting the libraries not only in the conventional sense, but also with new techniques, such as mechanized information retrieval systems, specialized compilations or summaries, expanded copying and distribution devices, more extensive cataloguing, and the training of more specialized personnel to provide such services.

The first objective is to add to the treasury of scientific fact, some of which could well be lost in the sheer weight of data, and to develop greater quality in our national medical activities.

At this point I have barely mentioned the problems of the practicing physician and the difficulties of what correctly is referred to as his continuing education. The education of health practitioners, like the education of all people in the sciences, must continue all their lives. Their main sources of help are the medical libraries, in the schools of medicine, dentistry, osteopathy, and public health, in the medical societies, and in the hospitals. They must have available, quickly and easily, the books and journals they need, plus the faster techniques to help them find what they want. If we deny this to them we are defeating the whole purpose of our health effort.

How many people are we talking about? In total numbers, we are talking about a working force second in the nation only to agriculture and the building trades--between 3 and 4 million people in the health service occupations and industries. (2) This includes all types of health practitioners and other types of workers in the health sciences. If we consider the field of medicine only, there are more than 250,000 physicians, more than 37,000 residents, more than 12,000 interns, (3) and 32,000 medical students.

It is obvious that these people must have all the help they can get; and yet, as we have noted, medical library resources are years behind the times. The present and future health of the nation demands immediate action. That the problems are, to a great extent, the result of Federal emphasis on health and medical services, is all the more reason why the Federal government now must take the lead in instituting corrective action.

Last January, in company with the distinguished Senator from Alabama, Mr. Hill, I introduced the Medical Library Assistance Act of 1965, which is designed to speed and improve the processes of medical communication in this country by assisting the medical libraries. The need for such a measure is self-evident; but I frankly confess to a personal interest in the measure because one of the great health science institutions of the country is in my state of Arkansas. And I refer, of course, to the University of Arkansas and its schools of medicine, nursing, pharmacy, and other activities.

Our Medical Center in Arkansas probably is a good example of what has happened to medicine throughout the nation in the past decade or two. This new facility--and we are quite proud of it both from the standpoint of modern design and the new or expanded educational and service programs which it has made possible--was activated in 1956. In that short time, it already has become pressed for additional space and facilities.

When our Medical Center was opened in 1956, it appeared that the then available space for the library would not be used up for several decades. The reading room alone was larger than the total area occupied previously by the library. Yet today--nine years later--space is at a premium. In the library's efforts to maintain the proper inventory of references needed in this day of tremendously rapid revisions and additions to medical knowledge, the services and facilities are strained.

Aside from the needs of medical teachers and students, our Medical Center--and I am sure this applies generally throughout the nation--feels an obligation to the doctors of Arkansas to keep them abreast of new medical discoveries. That such a service is expected by many physicians is evident. In the past ten years in my state, the number of loans made by the medical library to persons outside the city of Little Rock has increased by 300 percent, with most of the requests for material coming from doctors out in the state. And certainly the practicing physician within the city--who has close access to the library--makes even heavier use of it.

I think it would be very fitting here today if I were to read what Dr. Billings said about his experience as a student a century ago. One of the graduation requirements at the Medical College of Ohio where he was studying was the writing of a dissertation. To find the information he needed, Billings ransacked public and private libraries in Cincinnati, New York, Philadelphia and elsewhere.

> After about six months of this sort of work and correspondence I became convinced of three things. The first was, that it involves a vast amount of time and labour to search through a thousand volumes of medical books and journals for items on a particular subject, and that the indexes of such books and journals cannot always be relied on as a guide to their contents. The second was, that there are, in existence somewhere, over 100,000 volumes of such medical books and journals, not counting pamphlets and reprints. And the third was, that while there was nowhere, in the world, a library which contained all medical literature, there was not in the United States any fairly good library, one in which a student might hope to find a large part of the literature relating to any medical subject, and that if one wished to do good bibliographical work to verify the references given by European medical writers, or to make reasonably sure that one had before him all that had been seen or done by previous observers or experimenters on a given subject, he must go to Europe and visit, not merely one, but several of the great capital cities in order to accomplish his desire.
>
> It was this experience which led me when a favourable opportunity offered at the close of the war, to try to establish, for the use of American physicians, a fairly complete medical library, and in connection with this to prepare a comprehensive catalogue and index which should spare medical teachers and writers the drudgery of consulting ten thousand or more different indexes, or of turning over the leaves of as many volumes to find the dozen or so references of which they might be in search. (4)

Thus, the whole occasion for our being here today began, more than 100 years ago, with a problem of medical education. It was Dr. Billings' problem in getting medical information needed for his degree that later prompted him to become concerned with libraries and set off the entire chain of events leading to this day.

The occasion began over 100 years ago, but the task is not finished. If Dr. Billings as a student had problems in the 1850's with the relatively scant medical literature of that period, consider the plight of the students in the health sciences today. Because of Dr. Billings' problems, and his later achievements, we have the benefit of far better literature tools than he did. But the health challenge to this nation today also exceeds by several orders of magnitude the problems of medicine and health in the 1850's. Therefore our responsibilities to the present and the future are much heavier and more demanding. I would like to cite a report released several weeks ago by the Association of American Medical Colleges. This report followed a year-long study on medical education. The charge to a special committee under Dr. Lowell T. Coggeshall of the University of Chicago was to consider what changes, if any, and of what type, should be made to improve medical education. Let me quote from the letter Dr. Coggeshall wrote to accompany the report:

> "Few persons interviewed believe improvements needed are matters of minor adjustment. More point to the need to take major steps to improve medical education to enable the nation to produce more and better prepared physicians and other health personnel. There is a rather consistent pattern of thought that the quality of education is good but not fully geared to future needs."

If indeed medical education in this country is not fully geared to future needs, then the libraries are even farther behind the advanced degree of effectiveness and productivity which they must achieve.

The top administrator at the Arkansas Medical Center stated in a letter to me several months ago that he considered the library "at the very center of our programs of undergraduate, graduate and continuing education." But while Federal money in support of research keeps adding to the storehouse of knowledge--which in turn feeds directly into the teaching programs--nothing is being appropriated in support of the medical libraries.

Therefore, I cannot overemphasize the importance of the Medical Library Assistance Act and all of its provisions. None of the sections of this bill have been developed without the most careful consideration of national needs. All are well aimed to set into motion a series of activities designed to provide assistance in a number of critical information and library areas.

With respect to medical education particularly, however, I would like to draw attention to the provision for regional libraries. In addition to the 81,000 medical students, interns and residents, there are an additional 170,000 students of dentistry, nursing, osteopathy, public health, and other aspects of the health sciences. These young people and their institutions are spread across the nation. There are needs for regional libraries other than for medical education, but even if there were no other reason, I would contend that the challenges of education in the health sciences were quite adequate to justify the strengthening of our health science information resources on a regional basis. The needs of our health-related educational programs, and the needs for regional resources, are basic to the entire national health endeavor.

No institution in the world has had more experience in providing library services to all aspects of medicine, than the National Library of Medicine, and the success of NLM in meeting its national responsibilities is known around the world. It is therefore to NLM that I look to provide leadership in this important area of regional development of library resources. The Medical Library Assistance Act must be passed, and quickly, so NLM can set to work to share its information and technology with all who need it.

The call to greatness being sounded across the country in many ways necessarily begins with the health of our human resources, and the most fundamental requirement is properly educating our health science personnel. Adequate library services are one of the most important and yet one of the simplest and least expensive prerequisites to this end.

Let us face this need and meet it squarely.

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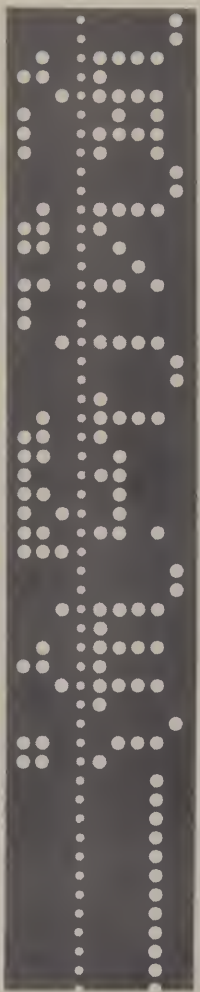

The Medical Library Crisis--
Billings to Medlars

By The Honorable Lister Hill
United States Senator, Alabama

"An institution is the lengthened shadow of one man" Ralph Waldo Emerson observed more than a century ago.

In a very real sense this great National Library of Medicine, whose centennial we observe here today, was woven out of the shadow and the substance of the vision and imagination of Dr. John Shaw Billings.

The man whose name and good works we honor here today was no pale academician. He started his career as a battlefield surgeon in the Civil War; some of his most moving letters describe the hardships and agonies associated with the crude surgery of that day and time.

After a particularly fierce battle in 1863, he wrote his wife: "I am utterly exhausted mentally and physically, have been operating night and day and still hard at work. I have been left here in charge of 700 wounded with no supplies."

Upon completion of his Civil War duties, he was assigned to the Office of the Surgeon General of the Army. Among his duties was the supervision of the Surgeon General's library. As a senior administrator, he had many other tasks to perform and the library itself, then located in Ford's Theater, seemed of relatively low priority to his fellow officers. But not to Billings. Early in his stewardship, he outlined the crisis then facing the library in these prophetic words:

> That there is need in this country of a medical library of this character is sufficiently evident from the fact that, in all the public medical libraries of the United States put together, it would not be possible to verify from the original authorities the references given by standard English or German authors, such as Hennen, Reynolds, or Virchow. No complete collection of American medical literature is in existence; and the most complete, if in this country, is in private hands, and not accessible to the public; while every year adds to the difficulty of forming such a collection as the Government should possess.

In the three decades he headed the library, he spoke unceasingly both here and abroad of the importance of a medical library in preserving the hard-won knowledge of the past and making it accessible to the medical practitioners of his day. Continually pressing for financial support, he wrote an endless stream of letters seeking donations of books to the collection. The extent of his success is illustrated in the fact that the library had only 2,200 volumes when he took over; when he retired thirty years later, it consisted of 116,000 volumes and 191,000 additional reference works.

Dr. Billings was not content to merely accumulate. Having himself been through the frustrations of digging through literally thousands of indices to locate the material he wanted, he boldly proclaimed the need for one comprehensive catalogue listing, under author and subject, all materials contained in the growing collection of the library. Thus the famous Index-Catalogue came into being. The first volume was not completed until 1880. The first series in sixteen volumes was not finished until his retirement fifteen years later.

Not content with the production of these massive catalogues, Dr. Billings also established the Index Medicus, the forerunner of the monthly publication which today keeps medical practitioners in all parts of the world abreast of the latest research knowledge.

Time permits but a brief mention of the many other contributions of John Shaw Billings.

He carried out a survey of the then Marine Hospital Service leading to the establishment of the U.S. Public Health Service as we know it today.

He influenced Andrew Carnegie in the establishment of the New York library system, and was the first director of the New York Public Library.

He designed Johns Hopkins Hospital and the Peter Bent Brigham Hospital, among others; he was influential in the revolutionary curriculum changes pioneered by Johns Hopkins in the 1890's, and he recruited Drs. William Osler and William H. Welch to the faculty of that great medical school in Baltimore.

As the most influential member of the National Board of Health, he launched the first federal grants for medical research, as Congressman Fogarty has pointed out in his address.

However, in his own time, he was most celebrated for his work in the development of medical libraries. In a speech dedicating a new building for the Boston Medical Library Association, Oliver Wendell Holmes, that great physician and man of letters, paid Dr. Billings the following tribute in 1878: "But it is from the National Medical Library in Washington"--notice what he called the Library even then--"that we have the best promise and the largest expectations. That great and growing collection of 50 thousand volumes"--this was 13 years after Billings had begun his work--"is under the eye and hand of a librarian who knows books and how to manage them. For libraries are the standing armies of civilization, and an army is but a mob without a general who can organize and marshall it so as to make it effective."

Judging from the remarks of Holmes and many others, it is fair to conclude that the tremendous importance of medical libraries was better recognized in the last century than it has been in the present one. Most of you here today know of the critical condition the Armed Forces Medical Library was in after World War II. Existing on inadequate appropriations and housed in antiquated facilities, susceptible to damage from the elements, the very existence of this great collection was threatened.

Here today I cannot pay sufficient tribute to the many leaders of American medicine who, deeply aware of this crisis, gave of themselves unstintingly to acquaint the Congress and the American people with the situation. Dr. Alan Gregg, that great statesman of American medicine, was tireless in his efforts; I very warmly remember many conversations we had about the future of the Library. I wish that time would permit an adequate tribute to the many doctors who served as Chairmen of the Board of Regents of the National Library of Medicine when it was transferred to the U.S. Public Health Service. Dr. Worth B. Daniels of Washington, D.C., served as its first Chairman, and he was succeeded in the office by such distinguished practitioners of medicine as Dr. I. S. Ravdin, Dr. Champ Lyons, Dr. Michael E. DeBakey, Dr. William B. Bean, Dr. Warner L. Wells, Dr. William L. Valk, and its present Chairman, Dr. Norman Q. Brill.

Equally important in achieving the goal of a truly great medical library were the two post-war directors of the Library--Dr. Joseph McNinch, who served from 1946 to 1949, and Dr. Frank Rogers, who succeeded Dr. McNinch and carried on the battle which culminated in the dedication of this beautiful new National Library of Medicine in 1961.

While justifiably proud of this magnificent institution here in Bethesda, we cannot ignore overwhelming evidence to the effect that medical libraries in other parts of the country have neither the financing, the equipment, nor the personnel to disseminate quickly to the practitioner of medicine the life-saving bounty of newly acquired research knowledge. We are not talking now of books and journals for future reference--we are talking of medical findings whose worth is meaningless unless they are applied to the disease problems of our time.

This gap in communications is one of the most serious crises confronting American medicine today. In 1962 the famous Dryer report, "Life Time Learning for Physicians," observed that the gulf between what is known in medicine and what is transmitted to the average practitioner is alarmingly wide. The report concluded that postgraduate medical education, the essential communications line between the medical center and the frequently isolated physician, was fifty years behind the times in terms of innovation and the use of new techniques.

The report of the President's Commission on Heart Disease, Cancer and Stroke--released two years after the Dryer report--reinforced its major conclusions. Noting the crucial importance of medical libraries in the continuing education of the physician, the Commission report was highly critical of the less than one million dollars spent in 1964 by the Public Health Service for grants-in-aid to medical libraries in various parts of the country. "Communication of information to scientists and practitioners is critically important to progress in research and application of medical knowledge," the Commission report observes. "Medical libraries are the primary vehicle for accomplishing the communications process."

On the basis of substantial evidence contained in the Dryer report and the report of the President's Commission on Heart Disease, Cancer and Stroke, and on the basis of an enormous amount of additional evidence obtained in Senate hearings over the years on our national medical education and research effort, I introduced the Medical Library Assistance Act of 1965 to provide federal grants to assist both in the operation of regional medical libraries and in the training of library personnel. I am happy that I have been joined in the sponsorship of this legislation by both Congressmen Harris and Fogarty.

In essence, this measure is designed to close the gap between the scientific break-through and the more important clinical follow-through. In a recent talk, the Surgeon General of the Public Health Service estimated that a minimum of 150,000 American

lives could be saved each year, and another one million people rescued from permanent disability, if we developed an effective communications system through which the fruits of our medical research were quickly transmitted to every doctor out on the firing line.

In this noble endeavor to bring the blessings of medical research to the sick, the halt, and the maimed, we must be ever daring in our aspirations. We must be worthy of the heritage of John Shaw Billings who, in his famous London speech, "Our Medical Literature," told the International Medical Congress: "This evidence of discontent and tendency to change is a good sign. In these matters stillness means sleep or death--and the fact that a stream is continually changing its bed shows that its course lies through fertile alluvium and not through sterile lava or granite."

In consecrating ourselves to the great task of preserving and transmitting our great medical heritage, we can draw needed strength from George Stewart's beautiful tribute at the opening of the Yale Medical Library a quarter of a century ago:

> "Here, silent, speak the great of other years, the story of their steep ascent from the unknown to the known, erring perchance in their best endeavor, succeeding often, where to their fellows they seemed most to fail.
>
> "Here, the distilled wisdom of the years, the slow deposit of knowledge gained and writ by weak, yet valorous men, who shirked not the difficult emprize;
>
> "Here is offered you the record of their days and deeds, their struggle to attain that light which God sheds on the mind of man, and which we know as Truth."

John Shaw Billings

Contributions to the Advancement of Medical Education

By Jean A. Curran

John Shaw Billings was undoubtedly an American genius whose prophetic vision and accomplishments did much to make medicine what it is today. He largely inspired such revolutionary developments in medical education as full-time leadership in clinical departments, highly selected, small classes of medical students, all with bachelor's degrees, and student participation in the bedside care of the patient. Further, he advocated consideration of the patient as a person, stressed the cultural and practical importance of medical history, and organized instruction in hygiene at both undergraduate and graduate levels. He saw early the importance of basic and clinical research in the advancement of knowledge. And his supreme achievement was to make medical literature available to all, the student, teacher, and practitioner.

While Billings' influence was felt predominantly at Johns Hopkins University, it was also significantly felt at Harvard, Pennsylvania, and other medical centers. The very catholicity of his interests and the range of his contributions have tended to obscure his essential role in advancing the fundamental concepts upon which present-day academic medicine is based. Not only did he foster the National Library of Medicine, he directed sanitary surveys, and he was one of the first to suggest the mechanization of data processing. He also became an authority on the design, construction, and ventilation of hospitals, and saw several of his designs carried to completion. Billings was such a "universal man" during these renaissance years of the late 19th and early 20th centuries that his vital part in advancing medical education has been underemphasized. Quite understandably, he is more frequently honored in Washington and New York as America's greatest librarian than as one of our outstanding medical educational statesmen.

It is doubly appropriate that we honor Billings since this year we are also celebrating the bicentennial of the first medical school in the country at Philadelphia, (1) established under the leadership of John Morgan, another pioneer in the evolution of modern concepts and ideals of medical education. Not only did

Billings follow Morgan just one hundred years later, but the period of his personal involvement fits almost exactly into the first half of the second century of our story.

When Morgan presented his famous "Discourse Upon the Institution of Medical Schools in America" at the Philadelphia College Commencement in 1765, his remarkable proposals and insights were many generations in advance of his time. And, while it is true that the seeds he planted regarding the high academic requirements essential for the preparation of the physician continued to germinate under the inspired figures who followed him--Shippen, Rush, and Wistar at Pennsylvania; Bard, Hosack, Mott, and Flint in New York; Warren, Waterhouse, and Dexter at Harvard--it remained for Billings to nurture to the full flowering our modern concepts of American medical education.

His soul-searching experiences as a Civil War surgeon, followed by the demonstration of his capacity for leadership and organization as an Army hospital administrator, gave Billings the background and opportunities to demonstrate his creative drive and clear vision of things to come. The following thirty years at the Surgeon General's Office and Library also enabled him to influence the progression of events which was to bring modern medicine in the United States at long last to indigenous maturity.

Yet fully a century after John Morgan's initial trail blazing, Billings still was some years in advance of his time. More fortunate than Morgan, he lived to see many of his dreams come true.

As we look back on that educational scene from today's vantage point, it seems surprising that so much time had to elapse after the achievement of political independence before our medical profession and institutions outgrew their colonial attitude of mind and their dependence upon the great European centers for special training and research opportunities. Although President Eliot at Harvard recognized as early as 1870 the need to develop graduate medicine in America, he was delayed in making it a reality. As a result, most ambitious young American physicians went to medical centers abroad throughout the nineteenth century and actually until the outbreak of World War I. It was into this opportunity vacuum that Billings was able to move and demonstrate in a comprehensive manner what adequate medical education should be.

When Billings began his epoch-making advances and contributions in the 1880's, medical education generally was little better than he had himself experienced just before the Civil War. There was no strict selection of candidates; indeed, almost any high school graduate, or even a student with less preparation, could secure admission to one of the then existing three-year courses. Few medical students were actually able to participate in the handling of patients, either as undergraduates or in the few internships then available, except in the extensively employed extramural preceptorships. With notable exceptions, it was still an era of the commercialization of medical education by proprietary medical schools, a state of affairs which Billings on more than one occasion castigated vigorously.

Undoubtedly, two of the great motivating experiences of Billings' life were his own woefully inadequate medical school course of two years in Ohio and his harrowing responsibilities for the administration of Army hospitals during the War, hospitals filled with battle casualties and infectious diseases, housed in wards reeking with infections of all kinds.

Hence, on coming to the Surgeon General's office, one of Billings' first assignments was to make a survey of the Marine Hospital Service over the period from 1869 to 1874. This led to improvement in efficiency and, eventually, to the transformation of that system into the United States Public Health Service. Billings' experiences, described in his reports to the Army Surgeon General "On Barracks and Hospitals" (Circular No. 4) and "On the Hygiene of the United States Army" (Circular No. 8), (2) further deepened his knowledge in these fields and their publication established his reputation as one of America's exponents of sound hospital management. His surveys were based on a knowledge of the history of hospital construction going back to the time of Tenon in France in 1788 and to Florence Nightingale in England in 1858 (founded upon her experiences in the Crimea). Infections, often referred to as "hospital gangrene," were of over-riding importance, and the control of them strongly influenced Billings to his concepts of the necessity for separate pavilions with isolated wards.

Even for a man with Billings' expert knowledge of teaching, hospital construction, and management, it may seem surprising that with so little previous academic experience, he could attain a place of such far-reaching influence in that discipline as well. The explanation appears as we follow the development of a self-taught genius. From early childhood, he was an omnivorous

reader, persuading his college classmates to borrow extra books for him and even invading the libraries by stealth on holidays and vacations. This pursuit of learning continued throughout his life, during which time he read and absorbed an astonishing amount of medical literature.

Such intellectual indulgence saved him from frustration during the two-year course of primitive quality at the Medical College of Ohio, a time which he later referred to as "the days when Plancus was consul." (3) The stereotyped, annually repeated lectures he seldom attended. His medical education there from 1858 to 1860 was obtained from books, clinics, house officerships at the St. Johns and the City Hospitals of Cincinnati, and working in the only "laboratory" connected with the school, the dissecting room. Like his reactions to the inadequacies of the medical libraries of that time, he carried from his medical school education a deep conviction of the need for reform.

Over the following years, Billings followed a plan of continuing self-education, based on his incredible reading habits. In an address at Radcliffe College in 1908, he confessed that, "I still skim more than 3,000 books a year to my own pleasure if not for others' benefit." (4) That would mean reading at a pace of eight to ten books a day, or approximately 130,000 volumes of print, to say nothing of periodicals, over a period of forty years. To a very real degree, he was a man of universal mind, in that he was able to mirror and utilize the full sweep of medical history, both from his reading and from his observations of advances in medical centers of the United States and Europe. His ability to analyze information and observations, judge their value, and then synthesize them into sound conclusions made him an efficient planner. Like Abraham Flexner, his very lack of medical school faculty experience gave him the advantage of a nonbiased and comprehensive perspective. Clearly, medical revolutions could not be made by physicians whose main interests were in maintaining the status quo!

During the early years in the Surgeon General's office, Billings' education continued, through the study of German and French, philosophy, medical history, and the then new science of microbiology. Thus he rounded out his store of knowledge and provided access to it by compiling comprehensive indexes. Through these studies, as well as through extensive travels, he prepared himself systematically for the tasks ahead.

In March 1873, the opportunity came. Mr. Johns Hopkins of Baltimore made available a site upon which to erect a hospital and provided an annual revenue for its construction. Mr. Hopkins, a Quaker, specified that the hospital should benefit the indigent sick of Baltimore, "without regard to sex, age or color." (5) When Hopkins died on December 24, the same year, the remainder of his estate was bequeathed to the hospital and the university. Thus the hospital was to become the first well endowed teaching institution in the United States. In view of Billings' very unusual and wide experience, it was not surprising that his plans for the new hospital were selected. He specified a unified administration, first class physiological and pathological laboratories, a dispensary for outpatients, to be connected with a building set apart for the instruction of students. Clinical instruction, he felt, should be given in the wards and outpatient departments, rather than in the amphitheatre as heretofore (except in the case of surgery). The emphasis, he felt, should be on charity, education, and science, in that order. He stressed that, beside the best of medical and surgical skill, good nursing and healthful surroundings, sympathy, and encouragement were as valuable to the patient as medicine. In Billings' words, the patient was "not to have his feelings hurt by being, against his will, brought before a large class of unsympathetic, noisy students, to be lectured over as if he were a curious sort of beetle." (6)

Another of Billings' dominant concerns was with public health. He had gained national recognition in that field through his studies of hygiene in the Army hospitals, studies which led to his selection as Vice President of the short-lived National Health Board in 1879, President of the American Public Health Association, and Chairman of the Public Health Section of the American Medical Association in 1880.

He was offered a position on the Hopkins faculty in this field. The Boston Medical and Surgical Journal for August 16, 1883, reported significantly:

> We learn that Dr. John S. Billings has declined the offer of professorship of Hygiene in the Johns Hopkins University, recently made him. The reasons which he assigns for doing so are that he cannot give up his position as surgeon in the army and superintendent of the National Medical Library, which he would be obliged to do if he accepted the position in question. He has consented, however, to deliver a course of lectures on Hygiene in the institution during the coming winter. (7)

This was ten years before the opening of the medical school at Johns Hopkins and was another straw in the wind pointing to subsequent developments, and eventuating in 1918 in the creation of the first endowed degree-granting School of Hygiene and Preventive Medicine in the United States.

As another recognition of Billings' extraordinary breadth and depth of knowledge in all fields of medicine, he was invited to give a course of twenty lectures to the faculty of Johns Hopkins University in 1877-78, some fifteen years before the medical school came into being. (8) He covered the history of medicine, medical legislation, and medical education in relation to the future university teaching in the hospital.*

In 1878, at the request of the Hopkins Trustees, Billings prepared a condensation of the twenty lectures to the faculty, especially the last ten, which dealt particularly with educational preparation of the physician. It is of historical interest that, when the page proofs were returned, he found that the part containing his recommendations on the preliminary course (the liberal arts program) had been eliminated. He wrote to President Gilman remonstrating against this, but received no reply, and in the abstracts from his lectures, printed by the Trustees, that part was omitted. Apparently the President and the Trustees felt Billings had gone too far afield! This deleted material can be seen now in the Library in New York. (9)

These lectures must have been a strong influence in establishing the concepts which were destined to make the Hopkins the distinctive prototype and pacemaker it became: even today, they are a valuable source of inspiration for the medical educator. Yet Billings was careful to credit other trail blazers. "No special originality is claimed," he emphasized, "since there is probably no one of these opinions which has not been previously expressed or acted upon by others." He expressly stated, "They were the result of consultation with leading medical men in this and other countries." (10) Specific references were made to an address by Henry Jacob Bigelow of

*Copies of some of that material and a wealth of other documents and letters largely in Billings' own script are now available at the New York Public Library (unfortunately largely undated). Although this material was probably available to Garrison when he prepared Billings' Memoir in 1915, it was boxed up for nearly fifty years, with no access possible until this past year. I should add that this resource is a valuable addition to an extensive collection of Dr. Billings' reprints and other memorabilia in my possession, generously given me by Mr. John S. Billings, 2nd, some years ago.

Harvard in 1871 and another by William Pepper in 1877, outlining the advanced ideals for the abortive American Academy of Medicine. He also paid tribute to Harvard Medical School for the introduction of the graded three year course and requirement of the bachelor's degree for admission in 1871. Like Flexner some thirty years later, Billings was a master of creative synthesis.

In commenting on the content of these lectures, it was Garrison's view that, "In this course, the lessons of medical history, the strange recurrence of certain medical theories in different periods, was deliberately applied to the elucidation of the status of medical education in such periods." (11)

As advisor to President Daniel Coit Gilman at Johns Hopkins, Billings rendered invaluable service in the selection of key members of the first medical faculty. When traveling in Germany before 1880, Billings had become deeply impressed with William H. Welch, then a student in Ludwig's laboratory in Leipzig. He urged Mr. Francis King, the President of the Johns Hopkins Hospital, who was with him in Leipzig, that Welch should be "one of the first men to be secured when the time came to begin the medical school." (12) In 1884, according to Garrison, "this important selection was made largely at the instance of Dr. Billings and of Professor Julius Cohnheim of Breslau, in whose laboratory Professor Welch had made a distinguished record." (13) As the first appointee to the Hopkins, Welch introduced both experimental pathology and experimental bacteriology to this country. His leadership as Dean of Johns Hopkins Medical School assured the success of the whole enterprise.

Sir William Osler, too, was a selection of Dr. Billings, and Osler gives a vivid account of a momentous visit to him by Billings as follows:

> An important interview I had with him illustrates the man and his methods. Early in the spring of 1889 he came to my rooms, Walnut Street, Philadelphia. We had heard a great deal about the Johns Hopkins Hospital, and knowing that he was virtually in charge, it at once flashed across my mind that he had come in connexion with it. Without sitting down, he asked me abruptly, "Will you take charge of the Medical Department of the Johns Hopkins Hospital?" Without a moment's hesitation I answered, "Yes." "See Welch about the details; we are to open very soon. I am very busy to-day, good-morning," and he was off, having been in my room not more than a couple of minutes. (14)

Welch was largely responsible for bringing on William S. Halsted of New York as Professor of Surgery. This initial group soon drew around them a brilliant coterie of research-minded teachers. Billings appears to have been the guardian angel of the whole development. He lectured on the history of medicine for a number of years; a hospital historical club was organized with Osler and Welch as active participants. Welch later succeeded Billings in the chair of the History of Medicine.

Looking back in 1915, Garrison declared:

> Thus Billings was a true prophet. All the fine things he had predicted for the Hospital, twelve years before its completion, came to pass in time. This home of the higher medicine did, in effect, realize the dreams and hopes of generations, as if, in the words of Goethe's Chorus Mysticus, the unattainable had at length become a reality.
>
> With Eliot of Harvard and Pepper of Philadelphia, Billings will always be remembered in our medical history as one of those who have dared greatly and achieved greatly for the advancement of higher medical education in this country. (15)

The spectacular reforms which followed Abraham Flexner's searching and celebrated survey and report of the medical schools of the United States, 1908-1910, were largely implementations of basic concepts advanced by Billings, by then adequately tested for validity at the Johns Hopkins, as our first true graduate medical center.

To return to Billings' lectures, he had stressed to the Johns Hopkins faculty in 1877-1878 that the prime purpose of the new school and hospital would be to prepare first-rate practitioners, an objective shared with Harvard, Michigan, and Pennsylvania. At the Hopkins, this would involve the introduction of the medical student to the bedside at an early stage in his education, allowing him to become an active participant in diagnostic studies and the provision of treatment. He urged that the major object of this School not be to produce general practitioners but to inculcate the spirit of inquiry and investigation along the line of special interests. Since the hospital was in full operation four years in advance of the opening of the medical school, the "big four," Welch, Osler, Halsted, and Kelly, along with their associates, were able to have their hospital programs well organized and to initiate the famous Hopkins residency system, a revolutionary way of preparing specialists.

After meeting the best standards of medical care and education, Billings stressed the demand "for the promotion of original research and discovery in Medicine, including the making known of these discoveries." He had commented, "In this field, we do not find any organized effort being made in this Country. In no University or College, Hospital or Asylum, do we find going on systematic and scientific investigations in Physiology, Pathology or Therapeutics, such as are being made in Germany--and, less generally and systematically, yet still to a great extent and with good results, in France and Great Britain." He went on to say, "Through a peculiar concatenation of circumstances, it is in the power of the Trustees of this University to do more for this object than can be effected by any Institution in this country, or perhaps in the world." (16)

The Doctorate of Medicine was to be restored to its original meaning, "that the holder is qualified to teach, as well as to practice . . . that the graduates shall be men who can when the occasion demands tell what they know, and why or how they know it." (17)

His recommendations regarding premedical qualifications--that all students must have Bachelor's degrees before being accepted at Johns Hopkins and that entering classes should be limited to twenty-five students--were adhered to. The proposal that clinical teachers should be salaried full-time had to await generous support by the Rockefeller Foundation and the overcoming of strenuous opposition, even from Sir William Osler. This step was not implemented until as late as 1913.

The length of the course was to be a full four years, instead of the three then current, the first two in the basic sciences, and the fourth year as resident in the hospital. It was one of Osler's proudest boasts that he, by making the student an active member of the medical team at the patient's bedside, inaugurated the clinical clerkship in America.

Billings also urged from the start that the teaching of medical history should be included, and he himself taught the first course. He urged it as "a means of culture, a stimulus to thought, [which] would save much labor and research when the time comes for the student to attempt to teach, either from the Professor's chair, or through the press." (18)

Of the use of the library he said, "it is sometimes more desirable that the student should know where a certain piece of

information is to be found than that he should attempt to remember the precise information itself." (19)

Other revolutionary proposals by Billings were the establishment of the specialties of pediatrics, psychiatry, and neurology.

His program for an Institute of Hygiene and Public Health was outlined in detail, although it did not become a reality at the Hopkins for another thirty years.

In his talk before the Yale faculty in 1891 on "Ideals of Medical Education," he dwelt upon the importance of a university atmosphere and referred to an address by William Welch three years earlier regarding the importance of "making the union of the school and the university close and intimate." (20) Billings cited the experience of Oxford in using "her resources in giving a broad foundation of literary and scientific culture, including . . . special instruction in general biology and comparative and human anatomy, physiology, and pathology," before going on to the great London schools for clinical training, as a commendable arrangement. (21)

Fortunately, Billings was a member of the Visiting Committee of the Harvard Medical School for the years 1888 to 1894, paralleling his years of contact with Johns Hopkins. In 1886 he was invited to give a series of six lectures on medical history there. His influence was far-reaching, for a specific contribution by him was the design of one of Harvard's outstanding teaching-research units, the Peter Bent Brigham Hospital.

At a Harvard Medical Alumni Banquet in 1894, Billings paid tribute to the advances made at the Harvard Medical School, saying, "Harvard is now, as she has been, in the very front of the medical schools of this country in all improvements that have been made." (22)

William W. Keen, Professor of Surgery at the Jefferson Medical College, another speaker on that occasion (along with William Osler), complimented Billings on the speech he had made previously in Washington on "Methods of Teaching Surgery" and especially his terse summarization of the essential elements which were, "who were to be taught, what was to be taught, and how it was to be taught." (23) In that presentation, Billings first outlined what the undergraduate's introduction to surgery should be. Then, for the graduate, beside a broad foundation in the basic sciences including surgical anatomy, he emphasized that technical

skill, important as it is, "is secondary . . . to skill in diagnosis, and to knowledge of therapeutical methods which do not involve the use of the knife. . . . The most important of all is residence in a hospital, the working as assistant to a surgeon, the seeing and handling cases . . . ." (24)

In 1890, Billings began five years as Director of the University Hospital of Pennsylvania. There he created the first laboratory of hygiene, served as its Director and as Professor of Hygiene. Those years, though pleasant, proved to be a transient and somewhat anticlimactic experience.

In 1896, he became Director of the New York Public Library. There he continued his medical research interests, especially on alcoholism and its psychological aspects. In 1901, in his report on "Progress of Medicine in the Nineteenth Century" published by the Smithsonian Institution, (25) Billings expressed the belief that greater advances had been made in the previous one hundred years than in the antecedent two thousand. This was especially true of the years following 1880, due to the discovery of specific microorganisms as the causes of infectious diseases, making possible prevention of these afflictions and ushering in the whole modern era of preventive medicine.

He concluded this report in characteristic and more prophetic vein than he could have anticipated when he said:

> These methods have been as yet only partially applied, and great results are to be hoped from their extension in the near future. They will not lead to the discovery of an elixir of life, and the increasing feebleness of old age will continue to be the certain result of living a long time, for the tissues and organs of each man have a definitely limited term of duration peculiar to himself; but many of the disorders which make life a burden in advancing years can now be palliated or so dealt with as to secure comparative comfort to the patient, so that "if by reason of strength" life can be prolonged beyond three-score years and ten, it no longer necessarily involves labor and sorrow. (26)

So he anticipated geriatric medicine!

And now, to come full circle, it seems clear that John Shaw Billings was the prophetic guide in the evolution of modern medical education. He was not only the designer of the Johns Hopkins and Peter Bent Brigham Hospitals, but he was an original architect

of the plans for high quality medical education. It was primarily his thinking which was dramatized by the Flexner survey of 1910 and implemented by the Councils of the American Medical Association, the Association of American Medical Colleges, and other potent forces, especially the General Education Board and the Rockefeller Foundation. Thus his aims gradually were realized, aims focussed on the improvement of medical education, the care of patients, and the prevention of disease. In the words of Owsei Temkin at the recent dedication of Harvard's Countway Library of Medicine: "The historian may try to elucidate the past for the sake of the present: but to elucidate the future remains the task of the prophet." Billings was such a prophet.

Every medical school and teaching hospital in the United States and in many other parts of the world have the impress of Billings' genius and concepts upon them. Although less visible and tangible than this great National Library, they too are, none the less, his living memorial in the Centennial year!

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U.S. PUBLIC HEALTH SERVICE
* 1798 *

As Billings Ordered--Public Health

By Bess Furman

One keynote to a vast and varied contribution of Dr. John S. Billings in the field of public health was his repetition, hundreds and hundreds of times, of the phrase "It is ordered," or just the word "Ordered." What Dr. Billings was able to accomplish through the National Board of Health with the one word "Ordered" struck me with terrific impact when I started to read the hand-written volume I have here. It is titled: "U.S. National Board of Health; Minutes of Executive Committee, 1879." It is the first of three sizeable volumes which show precisely how Dr. Billings operated. I became so enchanted I read all three, 1879, 1880, and 1881.

Dr. Billings had an orderly mind. He was a physician, a statistician, and a sanitarian. He was, in fact, the "Mr. Clean" of his era. This marks him as a sort of Magical Man. He would take a look at a situation that endangered the public health and would simply say, "It is ordered that this be changed." He then would call the matter to the attention of the man, or group of men, with the actual authority to change it--the President of the United States, Congress, the State Department, the State Board of Health, or whatever. And lo--more times than would be believable--the thing was done--just what Dr. Billings ordered.

This was the more remarkable in that Dr. Billings did not at all believe in dictators, mandates, or centralized power. When he finally got a National Board of Health organized--with himself as its virtual dictator under the title of Vice-President--he made it perfectly clear to everyone that its only province was to review and respond to the actions of State and local Boards of Health. Then he made clear to prominent physicians in all cities that the only way to get money for public health purposes out of the Federal Government was to organize State and local boards of health and take action as indicated by the National Board of Health. By this elaborate method, Dr. Billings accomplished many things.

As one remarkable example, he had yellow fever intensively studied by a special United States commission in Havana, Cuba. This group of experts not only made studies with the microscope

on diseased tissue, but also reported on the actual sanitary conditions of the principal ports in Cuba from which shipments were made to the United States.

Only recently I learned from Dr. Fred Soper that the work of the Havana Yellow Fever Commission in 1879 changed the thinking of Dr. Carlos Finlay, Cuban yellow fever expert, who had been appointed by the Spanish Governor General to work with the U.S. Commission. Dr. Finlay had made many speeches saying this fever was caused by alkalinity in the air. Because he noted changes in the blood vessels in the microscopic studies, Dr. Finlay turned to mosquitoes as its vector, a position he continued to take until it was scientifically proven by Dr. Walter Reed. All Dr. Finlay lacked to prove his case against the mosquito was the theory of the extrinsic incubation period--the time required to develop the disease in the mosquito--which Dr. Henry R. Carter, of the Public Health Service, developed and put into the hands of Dr. Reed and his helpers. The man who started this chain reaction was Dr. Billings.

Dr. Billings organized sanitary surveys of the principal Atlantic Ocean and Gulf of Mexico ports. Just name them and there they are in the printed records of the Board of Health: New York City and its environs; Portland, Maine; Philadelphia, Baltimore, Wilmington, Charleston, Savannah, St. Augustine, and on around to New Orleans.

The first 71 pages of these written minutes are Index, which is par for the course with Dr. Billings, the originator of Index Medicus. Always he indexed.

One of the early passages runs: "Ordered that the Secretary be allowed to purchase an Electric Pen in place of the Papyrograph already ordered." Wondering what on earth an electric pen could have been, and how it differed from the Papyrograph it replaced, I had my secretary look them both up in dictionaries with results as follows: Electric pen: "A hand pen for making stencils that consists essentially of a puncturing needle and a small magneto electric device for making it reciprocate." Papyrograph: "Name of an apparatus patented (1874) by E. Zuccato for copying documents by chemical agents acting through a porous paper-stencil." The electric pen which would simultaneously make several copies fitted perfectly into the varied purposes of Dr. Billings.

In the massive correspondence saved by Dr. Billings are letters of appreciation from physicians out over the country for copies of articles on the treatment of diseases which he had

sent to them. It was he who started the vast system of free-of-cost dissemination of up-to-date medical information to physicians and researchers which still goes on in this Library which he started. The National Library of Medicine annually responds to about 150,000 requests for medical articles; and last year sent out about 2,000,000 pages of Xerox material under the rule, "Only one copy per person." This is a public health service just as Dr. Billings ordered.

The National Board of Health created late in the night of March 3, 1879, as one of the last acts of a dying Congress held its first meeting almost a month later on April 2. The Board consisted of seven physicians, no two from any one State; and of a representative of the Army, of the Navy, of the Marine Hospital Service, and of the Department of Justice. Dr. James L. Cabell, of the University of Virginia, was its President, and Dr. Billings, its Vice-President. These happened to be precisely the same two posts held by these two gentlemen in the American Public Health Association, powerful lobbying organization in the sanitary field.

Obviously a group so large and geographically scattered could meet only intermittently. So the Board was really run by its Executive Committee which met several times a week between Board meetings. The regular attendants were the federally paid members who lived in Washington, D.C.: Dr. Billings, of the Army; Dr. Thomas J. Turner, of the Navy; Dr. Preston H. Bailhache, of the Marine Hospital Service, and, infrequently, Samuel F. Phillips, of the Department of Justice. Dr. Turner soon came to regard Dr. Billings with complete hero-worship. This tended to make for a working majority in which Dr. Bailhache of the Marine Hospital Service, forerunner of the Public Health Service, was sure to come out second-best.

Certainly one of the most amazing entries to find any time in any place is the first in this log, dated April 2, 1879. That was the night of the day the Board first met. The Executive Committee came together at the Medical Museum in Ford's Theatre where Dr. Billings was in charge of both the Museum and the Surgeon General's Library. The announced purpose of the meeting was merely to order the printing of a notification to physicians and others of the establishment of the Board of Health. That was over with in one short paragraph.

Then came this sentence: "Dr. Billings submitted the following memoranda." The four pages of closely written script which followed were enough to raise anybody's eyebrows.

This early entry did not say, "It is ordered." It merely said: "It is recommended." The law creating the National Board of Health had carried only a $50,000 appropriation. Dr. Billings proposed that Congress give the Board an appropriation of $500,000 to aid State and local Boards of health on quarantine and other control measures when large-scale epidemics broke out. Here was a man who envisaged the barely organized National Board of Health at ten times its initial scope.

The Act creating the National Board of Health dealt only in glittering generalities. Dr. Billings in his four-page memorandum was far more specific. He recommended that Congress turn over to the Board of Health the quarantine power and the foreign disease information system and publication of the Marine Hospital Service. He further said that the Board should be able to borrow the services, at no extra cost, of scientific experts anywhere in Government. He said at least $20,000 should be set aside to finance the work of the Havana Yellow Fever Commission. And he called on the Board to "Undertake a special investigation into the adulteration of food and drugs in this country"--a problem recently rediscovered by our Government.

Just how bold and opportunistic was his move to take two of the most prized functions from the Marine Hospital Service can only be understood by a review of the events leading up to it. In 1879, the Marine Hospital Service had been organized only nine years under a Supervising Surgeon General. It had, however, been in existence under the Department of the Treasury ever since 1798 in the John Adams administration. Thus, for 80 years, it had consisted of a compulsory insurance fund for the hospital treatment of merchant seamen, together with a few scattered hospitals where they could be treated. There was only one clerk in the Treasury Department keeping track of the Marine hospitals and the Marine Hospital Fund.

Dr. Billings had been called in as consultant by the Secretary of the Treasury to visit and help organize these hospitals under a Supervisory Surgeon General. He had expected to become the first such Surgeon General, and Secretary of the Treasury George S. Boutwell intended to appoint him to that post. However, Congress passed a law deliberately ruling Dr. Billings out by striking out the section making it possible for the President to detail an Army or Navy officer as Supervising Surgeon General, and specifying instead a civilian who could give full time to the job. Secretary Boutwell asked Congress to change the law so

as to "permit the President to detail a surgeon of the Army or Navy to perform the duty of Superintendent. With such authority the Department could have the benefit of the services of Dr. Billings."

But Congress would not change the law and Secretary Boutwell appointed Dr. John M. Woodworth as the first Supervising Surgeon General. Soon, Dr. Woodworth, of the Marine Hospital Service, and Dr. Billings, of the Army, were locked in bureaucratic battle. When Dr. Billings prepared for Congress a learned report on the cholera epidemic of 1873, Dr. Woodworth stole the whole cholera show by sending President Ulysses S. Grant his own cholera report. Dr. Woodworth recommended that the President use his powers to require consuls overseas to cable epidemic reports to the Marine Hospital Service for weekly publication. This was done.

Then Surgeon General Woodworth started working for a National Quarantine Act. Congress passed it on April 2, 1878--but without an appropriation. Without financing, this quarantine act proved so futile that Surgeon General Woodworth drafted another piece of legislation, widely known as the Woodworth bill, which would make a single man head of a federal health agency with an appropriation large enough to finance quarantine. The Woodworth bill was voted by the Senate. Dr. Billings took the stand that any one man heading a federal health agency would be far too powerful. Strongly backed by the American Public Health Association, Dr. Billings got the House to strike out all but the enacting clause of the Woodworth Bill and substitute the Billings bill, to create a National Board of Health. In eleven days Surgeon General John M. Woodworth, of the Marine Hospital Service, was dead at the age of forty-one. President Rutherford B. Hayes attended his elaborate funeral services.

Less than a month later, Dr. John M. Woodworth's successor, Dr. John B. Hamilton, took the oath of office as Surgeon General of the Marine Hospital Service. That very night Dr. John S. Billings made his astounding proposal for a National Board of Health appropriation of ten times its original size--and also for taking over from the Marine Hospital Service its quarantine authority and its system of foreign reporting of disease. Dr. Billings got all he asked for and more in a law signed by President Rutherford B. Hayes on June 2, 1879. He got his $500,000; his quarantine powers; his Havana Yellow Fever Commission; his investigation into the adulteration of food and drugs; his promotion of State and local boards of health; his State Department reporting

system on foreign epidemics--and the Bulletin of the Marine Hospital Service became the National Board of Health Bulletin with Dr. Billings as its editor.

Dr. Billings was out of town, at an American Medical Association meeting in Atlanta, when the Act was voted, with a last sentence which certainly was not pleasing to him. This last sentence, for which Dr. John Hamilton of the Marine Hospital Service may have done some lobbying, stated: "This Act shall not continue in force for a longer period than four years from the date of its approval." In other words, a terminal date of June 2, 1883, was written into the law, and would end the National Board of Health unless Dr. Billings and the American Public Health Association could convince Congress it should be extended. As a matter of fact, its actual work ended even sooner, though its last report was dated 1885.

Dr. Billings performed many important duties other than the many he undertook for the National Board of Health during the three years, 1879, 1880, 1881, covered in its log. When his name disappeared from the National Board of Health as its Vice-President--that was in 1882--the log of the Executive Committee disappeared too. All through those three years, Dr. Billings was handling as many other public health projects as a juggler does Indian clubs.

Here are just a few of the many examples:

He started lobbying through Congress a new fireproof building on the Mall for the Army Medical Museum and the Library of the Surgeon General, which he headed.

He was issuing in that Library the first volume of the Index Catalogue covering medical literature from A to Berlinski, a quarto of 888 pages.

He was initiating, month by month, the publication of the Index Medicus, a classified record of current medical literature.

He was in charge of the vital statistics of the decennial census taken in 1880, which also turned out to be pioneering for the Public Health Service.

He was, as you have heard, concerned with the construction of the Johns Hopkins Hospital, in Baltimore.

What wonder that at the meetings of the Executive Council of the National Board of Health he kept saying over and over, "It is ordered," and "Ordered," "Ordered," "Ordered."

From the log I quote orders concerning the President on down to local physicians:

"Ordered--That a communication be forwarded to the President of the United States asking for the detail of a medical officer skilled in Naval hygiene to serve in the Office of the Consul of Havana and also one to serve at Port-au-Prince."

"Ordered--That the Secretary be directed to address a letter to the Hon. Carl Schurz, Secretary of the Interior, requesting to be furnished with the plans and specifications of all patents relating to sanitary matters since Jan. 1, 1879."

"Ordered--That Dr. J. S. Billings be authorized to investigate and report in regard to the printing of blanks concerning the mode of collecting information upon any disease likely to become epidemic."

"Ordered--That the Secretary be directed to have 100 copies of the letter to Governors of States printed, leaving addresses and signature blank, and that the circular to State Boards of Health be prepared in mass to be signed by the President and Secretary and issued by them."

"Ordered--That the Secretary be authorized to purchase 12,000 postal cards for obtaining weekly reports for the Bulletin."

"Ordered--That the Secretary be directed to obtain as nearly as possible an accurate list of the physicians of the United States."

On each city that Dr. Billings ordered surveyed, he specified that he wanted all the sanitary facts regarding water, housing, streets, schools, hospitals, sewage, garbage collection, cemeteries, slaughter houses, and quarantine. He said these facts would establish the foundation of a national public hygiene in this country. When yellow fever broke out in Memphis, Tennessee, Dr. Billings personally conducted the house-to-house sanitary survey. Never before had so many facts been assembled on any one city.

But in New Orleans, where yellow fever also appeared, it was a different story. Dr. Samuel M. Bemiss, the member of the National Board of Health in charge in New Orleans, was beset with trouble. Much of it was due to conflicts between his orders from Dr. Billings, in Washington, and the contrary opinions, in New Orleans, of Dr. Joseph Jones, the President of the Louisiana Board of Health.

Threading through the letters and logs giving a closeup of the New Orleans fight on yellow fever is the strange story of the phantom refrigeration ship which was being actively sponsored by Dr. John Shaw Billings. Professor John Gamgee, of London, came to this country as the inventor of this refrigeration ship. He lectured around the country painting rosy pictures of an air-conditioned era such as we now are in. His chief claim was that yellow fever, which always went away with frost, could be killed by chilling, in his proposed refrigeration ship, cargoes and the clothing of passengers of incoming ships.

I found in a Dr. Billings scrapbook one of Professor Gamgee's speeches. In New Orleans he said: "The method of operating high-pressure gases in my thermo glacial engines will enable us to cool dwellings, country-houses--indeed a whole city--at very little, if any excess of expenditure over that required to warm a Northern city during the winter months. New Orleans, Vera Cruz, and Calcutta, can, and doubtless will, hereafter enjoy whatever climate the will and wants of man demand within the limits of residences, theaters, halls, factories, and ships."

Dr. John Shaw Billings, who was in his heyday of getting bills through Congress, got an Act passed on April 18, 1879, "to authorize the Secretary of the Treasury to contract for the construction of a refrigeration ship for the disinfection of vessels and cargoes." The Act carried a $200,000 appropriation for construction to start at once. The National Board of Health, as assigned, considered all offers, and recommended that Dr. Gamgee be commissioned to build the ship.

Dr. Billings thought the matter settled, and went South to get rid of an illness. However, Secretary of the Treasury John Sherman referred the entire matter of the refrigeration ship for final decision to Dr. John B. Hamilton, Surgeon General of the Marine Hospital Service. And Dr. Hamilton, with revenge in his heart for the functions such as quarantine which Dr. Billings had been able to take from the Marine Hospital Service, took

pleasure in making a visit to Dr. Turner, Secretary of the National Board of Health, in the absence of Dr. Billings.

Dr. Turner immediately wrote an agonized letter to Dr. Billings blaming Dr. Bailhache, the Marine Hospital Service member of the National Board of Health. From it I quote: "Bailhache has an office in Hamilton's branch and there is nothing that goes on but is posted--and he of course knows every card in our hand, and in his own also. I see very clearly that they propose to run, or to break up, this Board."

The Treasury Department decreed that the refrigeration ship contract would have to be let on competitive bids. Dr. Gamgee flatly refused to turn the specifications of his scientific invention over to competitive bidding. Dr. Hamilton saw to it that the refrigeration ship never did get built. But it is nice to know that as we enjoy air-conditioning in this Library, Dr. Billings ordered it in 1879, eighty-six years ago.

Dr. Billings spent the half million dollars that he acquired for the National Board of Health wisely and well. He neatly accounted for it all himself, and pasted that accounting into one of three National Board of Health scrapbooks of newspaper clippings which he left in the New York Public Library. In my opinion it is a pity they are not at the National Library of Medicine where they started. This accounting is to the last cent.

As very first grants-in-aid ever to go from the Federal Government to State Boards of Health, Dr. Billings gave $36,292.44 to Tennessee; $7,026.64 to Mississippi, and so on. These grants to fight yellow fever were forerunners of the federal grants-in-aid which have been given by the Public Health Service under the Social Security Act.

Dr. Billings also gave the first federal research grants to competent experts. Most of the nineteen such experimental studies subsidized by the National Board of Health were studies of air, water, disinfectants, and diseases in man and animals. They were awarded to professors in famous colleges, such as Johns Hopkins, Harvard, Columbia, Cornell, and University of Virginia. Such studies are now, of course, a part of the annual billion-dollar grant business of the National Institutes of Health.

So we have, in a large way today, a Public Health Service just as Dr. Billings ordered back in 1879, 1880, and 1881. Dramatic indeed was the meeting of the American Public Health

Association in New Orleans in December of 1880, conducted by Dr. John S. Billings, as President. He was well on his way to becoming an international medical hero.

The 1881 volume of the Executive Committee log of the National Board of Health has only about half as many pages as those of 1879 and 1880. That was because Dr. John Shaw Billings was invited to give the general address to the International Medical Congress meeting that summer in London, a great honor. The Surgeon General of the Army, Dr. Joseph K. Barnes, also sent him on medical missions all over Europe. Dr. Billings left this country on June 20, and returned in late November, heaped high with honors which included a dinner with the Prince of Wales.

However, while Dr. Billings was being feted in Europe, Dr. Hamilton, of the Marine Hospital Service arranged a device to take from him the $100,000-a-year epidemic appropriation on which he actually operated the National Board of Health. This device was to have Congress make this appropriation to the President of the United States, who would turn it over to the Secretary of the Treasury, who would turn it over to Dr. Hamilton as head of the Marine Hospital Service.

Dr. Billings got back to Washington in time to attend the Executive Committee meeting of December 14, 1881--the very last meeting written into the log. Present at that meeting were two distinguished Board members, Dr. James L. Cabell, of Virginia, President, and Dr. Stephen Smith, of New York, and the three faithful federal employees, Drs. Billings, Turner, and Bailhache.

The executive committee took action as though the Board would go on. It was ordered that Harold Olson be appointed as seaman on board the Day Dream, the Board's boat at Ship Island, quarantine station for New Orleans; that the subscribers to the Bulletin be told that copies would be limited because the Board's appropriation had been cut off; and, most important, that the President of the Board be authorized to send a communication to the President of the United States stating that cholera could not be controlled on incoming vessels "because of the difficulties which at present exist"--in other words, no funds.

From the 1881 log I now quote: "Dr. Billings suggested that probably it would have more effect if Drs. Cabell and Smith would take the communication just ordered to the President and point out the difficulties the Board has met with." But no amount

of effort brought back the appropriations, and Dr. Billings resigned from the National Board of Health in 1882. And Dr. Hamilton almost immediately got a yellow fever epidemic to fight in Brownsville, Texas, and his Marine Hospital Service went on to become the Public Health Service.

One last entry, however, from this last meeting in the Executive Committee log dated December 14, 1881: "Ordered--That the Secretary be authorized to make requisition for 12 copies each of the annual reports of 1879 - 80 - 81 to be bound in half turkey, one for each member of the Board, and one for the Office of the Board."

As Dr. Billings ordered for public health 84 years ago--the preservation of its history!

John Shaw Billings

The Life of John Shaw Billings*

By Frank B. Rogers

The portrait of John Shaw Billings which hangs in the National Library of Medicine shows him vested in the scarlet gown which he wore on the occasion of receiving the degree of Doctor of Civil Law at Oxford in June 1889. At the time of receiving this honorary degree, Billings was fifty-one years old, and for the moment was staying at the home of his friend, Sir Henry Acland. In the afternoon, after the ceremonies, the Aclands took Billings for a picnic on the river, carrying along a kettle and boiling tea on the bank. Billings sat, tired and silent, until Acland's young daughter insisted that Billings must tell the children a story. Billings promptly and very solemnly began:

> A traveling showman, going around with a Biblical panorama, thus described one of the pictures, "This, ladies and gentlemen, is a picture of Daniel in the Lion's Den and--you will be able to distinguish Daniel from the lions because he carries a green cotton umbrella." [1]

It is a revealing incident. Billings was musing on the past, reflecting on the long course of a lifetime which had led to a scarlet vestment and drinking tea on the banks of the Cherwell. He was thinking of another summer, 32 years earlier, and another Oxford, in southwestern Ohio near the Indiana border, where he had graduated second in his class from Miami University in 1857. He was penniless and hoped to obtain employment as a tutor so as to be able to pursue the study of medicine. Instead, he took a job with an itinerant exhibitor of lantern slides and toured the midwest delivering a rapid-fire running commentary on the startling scenes his employer flashed before an enthralled backwoods citizenry.

In 1858, at the age of twenty, he had matriculated at the Medical College of Ohio, founded by Daniel Drake 40 years earlier in a

*Reprinted from Selected Papers of John Shaw Billings, published by the Medical Library Association, 1965.

[1] Letter from Miss Acland to F. H. Garrison, quoted in Garrison's John Shaw Billings; a Memoir (New York, Putnam, 1915), p. 389.

booming Cincinnati that was then the largest metropolis west of the Alleghanies. As Billings later described it,

> . . . I graduated in medicine in a two years' course of five months' lectures each, the lectures being precisely the same for each year. ... In those two years I did not attend the systematic lectures very regularly. I found that by reading the textbooks, I could get more in the same time and with very much less trouble. I practically lived in the dissecting room and in the clinics, and the very first lecture I ever heard was a clinical lecture. ... [2]

He lived in the hospital, cleaning out the dissecting rooms and doing all sorts of odd jobs. At St. John's he was known to the nursing sisters as "St. John of the Hospital," because of his melancholy mien and his austere ways. The austerity was forced upon him by his financial condition; all one winter he budgeted his food bills at 75 cents a week, which went largely for milk and eggs.

He took his medical degree in 1860 and stayed on at the school as demonstrator of anatomy, one of a faculty of nine. A newspaper advertisement shows the fees for six months of lectures at the College, October through February, as $105. Billings considered going into private practice with his surgical professor, George Blackman, now remembered chiefly for his re-editing of Mott's edition of Velpeau.

But at the end of that February of 1861 dark events were brewing. Threats had been received against the life of the President-elect of the United States; in Philadelphia he boarded the regular sleeper to Washington, and Pinkerton men sat with drawn revolvers in the dark berths to either side of where he slept. Lincoln was inaugurated on March 4, and in April the guns fired on Fort Sumter. It was Billings' twenty-third birthday.

He took the examination for admission to the Medical Corps of the United States Army and passed first on the list. He served a preliminary period as a contract surgeon, then was appointed First Lieutenant and Assistant Surgeon in April 1862 and placed in charge of Cliffburne Hospital in the old cavalry barracks on the hill above Georgetown. At the end of August he was transferred to Philadelphia as executive officer of the hospital there and, a few days later, was married to Miss Kate Stevens. At the end of

[2] Boston Medical and Surgical Journal 131: 140-2 (1894).

March 1863 he reported for duty to Dr. Jonathan Letterman, Medical Director of the Army of the Potomac, then encamped near Fredericksburg. The Rappahannock river was crossed on April 28 and 29, and Billings performed his first surgery in the field as Hooker engaged Lee in the battle of Chancellorsville on May 2 and 3. Two months later he was with the Second Division of the Fifth Corps at Gettysburg; Dr. Curran has given us an account of how Billings established his regimental aid station at the base of Round Top.[3] Following the Draft Riots in New York City later in July, Billings was sent to New York with the Seventh Infantry, which pitched camp on Fifth Avenue just above Forty-ninth Street. He was reassigned to hospital duty on Bedloe's Island in New York harbor, and then in February 1864 was placed in charge of an extraordinary expedition to Haiti, to rescue 371 survivors of a group of freed slaves who had been resettled there and swindled in the process. At the end of March 1864 he again joined the Army of the Potomac, still bogged down between the Rapidan and the Rappahannock. As Medical Inspector for the Army, he roamed a wide front and lived through the Wilderness and Spottsylvania, Cold Harbor and the siege of Petersburg. By summer he was invalided back to Washington, and in the fall of 1864 was assigned for duty at the Surgeon General's Office. His field service was over.

In the wonderful biography of Billings which Garrison has left us, there is a long series of remarkable letters from Billings to his wife, covering in a vivid way the period of his duties in the field. Of these we note two short but typical fragments:

> July 9, 1863, Hospital near Gettysburg. . . . P.M. I am covered with blood and am tired out almost completely, and can only say that I wish I was with you tonight and could lie down and sleep for 16 hours without stopping. I have been operating all day long and have got the chief part of the butchering done in a satisfactory manner. . . .

> April 17, 1864. Nothing new or important yet. . . . Yesterday I went up to Culpeper, saw Major Dent, who inquired very specially after you, was introduced by him to General Grant and took dinner with the General and his staff. I like Genl. Grant. He is a thoroughbred gentleman and suits me exactly. . . .

[3] J. A. Curran, "Billings at Gettysburg" New England Journal of Medicine 269: 23-7 (1963).

The war over, Billings settled down to a routine of office duties. Curiously, he was worried at first that he would not have enough to do to occupy his time; he began the study of German, as he had once studied Latin and Greek as a boy, and undertook to teach himself something about microscopical studies. A contemporary[4] describes Billings' duties as "arid drudgery among invoices and receipts, requisitions and bills of lading, treasury drafts and auditor's decisions. His days were filled with routine office work, with questions of bookkeeping and pecuniary responsibility, with the supervision of checks and balances." He was detailed to the Secretary of the Treasury in 1869-70 to inspect the condition of the Marine Hospital Service, and prepared a reorganization plan which set that service, later renamed the Public Health Service, on a new course. During the period 1870-75 he prepared long reports on Army hospitals and Army hygiene. He planned a new hospital for the Soldiers' Home in Washington, he became active in the affairs of the American Public Health Association, and was for a short time vice-president of the ill-starred and short-lived National Board of Health. He was a founding member and later President of the Cosmos Club and of the Philosophical Society of Washington. He was elected a member of the National Academy of Sciences, and served as its treasurer from 1887 to 1898.

The wonder is that in the midst of all these activities, his major task for the 30 years from 1865 to 1895 was the direction of the Library of the Surgeon General's Office. The Library, which had occupied a few shelves behind the Surgeon General's desk since the days of Joseph Lovell and Andrew Jackson, numbered about 1,800 volumes at the close of the War. When Billings arrived, the man and the opportunity met. Years later, in a commencement address at his old medical school, Billings described what he had first envisioned in Cincinnati in 1860, while preparing his thesis on the surgical treatment of epilepsy.

> In the thesis just referred to, it was desirable to give the statistics of the results obtained from certain surgical operations as applied to the treatment of epilepsy. To find these data in their original and authentic form required the consulting of many books, and to get at these books I not only ransacked all the libraries, public and private, to which I could get access in Cincinnati, but for those volumes not found here (and these were the greater portion), search was made in Philadelphia, New York and elsewhere to ascertain if they were in any accessible libraries in this country.

[4] Alfred A. Woodhull.

After about six months of this sort of work and correspondence I became convinced of three things. The first was, that it involves a vast amount of time and labour to search through a thousand volumes of medical books and journals for items on a particular subject, and that the indexes of such books and journals cannot always be relied on as a guide to their contents. The second was, that there are, in existence somewhere, over 100,000 volumes of such medical books and journals, not counting pamphlets and reprints. And the third was, that while there was nowhere, in the world, a library which contained all medical literature, there was not in the United States any fairly good library, one in which a student might hope to find a large part of the literature relating to any medical subject; and that if one wished to do good bibliographical work to verify the references given by European medical writers, or to make reasonably sure that one had before him all that had been seen or done by previous observers or experimenters on a given subject, he must go to Europe and visit, not merely one, but several of the great capital cities in order to accomplish his desire.

It was this experience which led me when a favourable opportunity offered at the close of the war, to try to establish, for the use of American physicians, a fairly complete medical library, and in connection with this to prepare a comprehensive catalogue and index which should spare medical teachers and writers the drudgery of consulting ten thousand or more different indexes, or of turning over the leaves of as many volumes to find the dozen or so references of which they might be in search.[5]

Billings had to acquire and train a staff, he had to obtain the books, and he had to find housing for both. For a staff he had a dozen civilian employees, many of them former army hospital stewards; only a single member of the staff had had a college education. But they were dependable and reliable, and Billings trained them in the rudiments of bibliographic procedure for which at that time there were as yet no nationally accepted standards. To get the books, exchanges were instituted with medical societies and institutions, begging letters were written to private individuals at home and abroad, duplicates were amassed for subsequent swapping. Wrappers were printed in two languages, English and Japanese, and sent to Japan to facilitate mailing of journals from that newly opened country. Billings sent one of his clerks to copy

[5] Cincinnati Lancet-Clinic 20: 297-305 (1888).

the list of journal titles which had been compiled by Dr. Joseph M. Toner of Washington; he wrote to Dr. Thomas Windsor of Manchester, instituting a series of exchanges and gifts which were to form the backbone of the Library's historical collections; he was constantly on the prowl in the libraries of his friends, as Oliver Wendell Holmes and James R. Chadwick would later testify. He was lucky enough to receive a fund of some $85,000, the proceeds of the sale of properties left over from disbanded hospitals, and he used the money to triple the collection. It was the lone instance of having money available in any considerable amount; in later years the annual sums available to Billings for operating the Library would reach $10,000.

In 1867 the Library found quarters in the old Ford Theater building on Tenth Street. That building of tragic memory, originally a Baptist church before Mr. John T. Ford converted it for theatrical performances, had been purchased by the government for official use. For a while Billings and his staff remained at the Surgeon General's Office at Fifteenth Street and Pennsylvania Avenue, where the books were accessioned and processed before being carted over to Tenth Street. By 1880 the collections had grown to such a size that the need for a new building was imperative. Billings organized an intensive building campaign. Congress was bombarded by letters from physicians across the country; funds were appropriated in 1885; and the new building at the corner of Seventh Street and Independence Avenue was completed in the fall of 1887, at a cost of $200,000. The ground floor of the building was occupied by a section of the Adjutant General's Office; the east wing was occupied by the Army Medical Museum, which had been formally placed under Billings' charge in 1883; and the west wing with its four-tiered cast-iron bookstack was occupied by the Library. From high clerestory windows the light filtered down through stack floor gratings; on late winter afternoons the aid of a candle was sometimes needed to find the books on the lower shelves of the first stack level.

The growing collection had to be organized and cataloged. Small pamphlet catalogs had been printed in 1864 and 1865; the book catalog of 1868 lists over 6,000 volumes. The book catalog of 1872 ran to 431 pages, listed over 13,000 volumes, and was provided with a subject index. The catalog of 1873-74 was published in three volumes, and listed 50,000 titles of books and pamphlets. Then, in 1876, the Specimen Fasciculus of a Catalogue of the National Medical Library appeared. The title alone is noteworthy; "National Medical Library" appeared prominently in 28-point type; indeed, the letterheads of the Library during this period bore the

same legend. The Specimen set forth in dictionary order both books and periodical articles--the books listed by author and by subject, the periodical articles by subject only, in a single alphabet. On this plan, the first volume of the Index-Catalogue of the Library of the Surgeon General's Office appeared in 1880. The first series of the Index-Catalogue was to be completed in 16 volumes, in the year of Billings' retirement.

The rise of the periodical form of publication of scientific literature had been spectacular during the middle third of the nineteenth century. Billings recognized the importance of this new form and strove to cope with it. He had clothesbaskets full of journals delivered to his home in Georgetown, where he worked at night at the job of checking the items in each issue which he wanted indexed. Returned to the Library, the journals were processed by the Library clerks, who copied out the titles on cards which measured 4-1/4 x 6-1/8 inches. The next step sent the cards to Billings or to his great assistant, Dr. Robert Fletcher, who had joined the staff in 1876; they penciled a single appropriate subject rubric across the top of each card, which was then filed to await its proper sequence in the publication of the Index-Catalogue. Duplicate cards of current materials were made, and these were published, beginning in 1879, in the monthly Index-Medicus, for which the financial arrangements were handled on an extra-governmental basis. Thus Billings provided a bibliographic service for current awareness, along with another service designed primarily for retrospective search.

With all this activity, reference services were not neglected. Billings and his small staff somehow found the time to answer as many as two thousand inquiries per year. Billings also instituted a forerunner of today's inter-library loan system; physicians outside of Washington, on depositing $50.00, were allowed to borrow books from the Library, and the records show that William Osler, Howard Kelly, William Halsted, Reginald Fitz, Walter Reed, Rudolph Matas, and George Crile were among those who took advantage of that privilege.

That Billings possessed extraordinary reserves of physical stamina, as well as intellectual capacities, is shown by the fact that during this same period, beginning in 1875, he was closely involved in the development of the new Johns Hopkins Hospital and Medical School. Billings' plans were chosen for the new hospital, which was begun in 1877 and opened in 1889. No matter that those plans tolerated no elevator shafts, no matter that they provided for thick coats of asphalt on the floors, in deference to the

still prevalent idea that foul miasmas arising from the soil should be prevented from spreading, the plans represented a fresh new point of view and a departure from the old block buildings or rambling wooden pavilions of the past. And they embodied new ideas in medical education: there was to be a separate out-patient dispensary, first-class physiological and pathological laboratories, and a graded series of accommodations for private patients. During this time Billings was the chief medical adviser to Daniel Coit Gilman, the President of the new university. He arranged the curriculum for the new school: he insisted that its purpose must be to train investigators as well as practitioners; he was instrumental in bringing in Welch and Osler as the nucleus of the first staff. He placed emphasis on the keeping of proper records, financial and clinical; he taught courses in the history of medicine, commuting back and forth from Baltimore to Washington by train. He was giving his lectures on medical history elsewhere, as well--in Boston, in New York, and on some of his numerous trips abroad.

His interests in public health and vital statistics led to a position as consultant for the tenth, eleventh, and twelfth U.S. Censuses between 1880 and 1912, and he published voluminous reports of his findings. He stressed the necessity for morbidity as well as mortality statistics; he strove to get agreement on a standardized classification for reporting purposes. Of special interest to us of the present day, when the furor over machine methods of bibliography is at a peak, is the fact that it was a suggestion of Billings to Herman Hollerith, made over some chicken salad at Billings' home, which led to the development of punched-card tabulation. As Hollerith later wrote:

> ... and so it happened that one Sunday evening at Dr. B tea table he said to me there ought to be a machine for doing the purely mechanical work of tabulating population and similar statistics. . . . After studying the problem I went back to Dr. Billings and said I thought I could work out a solution for the problem and asked him would he go in with me. The Dr. said no he was not interested any further than to see some solution of the problem worked out. [6]

He went abroad often, buying books, visiting medical military installations, speaking at medical convocations, representing his

[6] Letter of August 7, 1919; quoted by J. Fraser Muirhead in his article "Doctors afield; John Shaw Billings," New England Journal of Medicine 268: 778-9 (1963). See also Frederick J. Rex, Jr., "Herman Hollerith, the first 'statistical engineer'." Computers and Automation, August 1961, pp. 10-3 [with an important bibliography of Hollerith].

country. His address at the International Medical Congress in London in 1881 was an enormous success and drew world-wide attention to the problems of a growing medical literature and to medical bibliography. In 1886 he was invited to speak before the British Medical Association, and his frank address on the state of American medicine, kindly and humorous and forthright though it was, drew some criticisms in this country and some disapprobation from organized medicine that did not abate for many years thereafter.

In 1895, after 30 years' service at the Library, President Cleveland granted his retirement from the Army, and he accepted a post as Professor of Hygiene at the University of Pennsylvania, at the insistence of his old friend, William Pepper, whom he had advised for some years. It was not an entirely happy move; Billings was a public health man of the old school, the statistician and the sanitary engineer, and did not feel too much at home in the direction of the type of laboratory investigations then becoming prominent. He attracted capable people, however, and gave them their heads. At the end of November 1895 a great banquet was held in Billings' honor in Philadelphia, and the medical community turned out in force. The toastmaster on this occasion was Billings' old friend, Weir Mitchell; Osler and DaCosta and Jacobi and Chadwick and Fletcher were there, and spoke of Billings' achievement. Osler read a message of congratulations from Surgeon General Sternberg, and announced that Billings' portrait was to be painted and presented to the Library. Billings was given a silver box, and inside it was a check for $10,000, which had been subscribed by friends in England and the United States.[7] Billings responded in his usual eloquent fashion, and was magnanimous in his praise of his colleagues. It must have been in many ways a tense situation for Billings, newly arrived in Philadelphia and under obligation to the University of Pennsylvania, for he had been told only three days before the banquet that he had been selected as the Director of the New York Public Library, then newly forming from an amalgamation of the Astor, Tilden, and Lenox libraries. Somehow he managed to work things out with Pepper; Weir Mitchell helped to smooth the way; and at the end of summer in 1896, after three months in Europe to attend the Royal Society's International Conference on Scientific Literature and study continental libraries, Billings moved to New York, there to spend the remaining 17 years of his life.

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[7] "Banquet and presentation in honor of John Shaw Billings, M.D., LL.D.," Medical News (Phila) 67: 634-41 (7 Dec 1895).

Billings set to work. He brought the Tilden books into the Lenox building and set up some two miles of temporary wooden shelving in the Astor building. He installed artificial lighting in both buildings. He drew up a scheme of classification of which he remarked that

> . . .it is not a copy of any classification used elsewhere; that it is not specially original; that it is not logical so far as the succession of different departments in relation to the operations of the human mind is concerned; that it is not recommended for any other library, and that no librarian of any other library would approve of it. . . .

He tried to reconcile the varying styles of cataloging, and brought in a system which was much like that of the Index-Catalogue, with periodical articles carded among the books. He successfully bargained with City officials and the State legislature for a building site on the land occupied by the old Croton reservoir at Fifth Avenue and Forty-Second Street. An architectural competition for the new building was held, plans were completed on the basis of rough pencil sketches which Billings had drawn up one day in Atlantic City in 1897, and the building was begun. The cornerstone was laid in 1902, and nine years later, in May 1911, the new building was opened to the public. The staff was reorganized; the collections grew from almost half a million volumes in 1901 to over a million volumes in 1913, while the 42 branch libraries which Billings established held another million volumes.

As usual, his extracurricular activities threatened to outstrip his more regular efforts. In 1902 he served as President of the American Library Association; between 1905 and 1908 he was engaged in drawing up plans for the Peter Bent Brigham Hospital in Boston, which he had the satisfaction of seeing completed in 1913; and from the founding of the Carnegie Institution of Washington in 1902 he served as a member of the Executive Committee, and from 1903 on as Chairman of the Board of Trustees.

In his last years, he had days when he preferred to keep to himself. Near the end he said to his deputy, "I no longer have any enthusiasm. I have acquired a tendency to oppose new things and new ideas." He was sometimes irascible with his colleagues in

the councils of the Carnegie Institution. "Walcott," he once said, "I seem to oppose everything, don't I?" The reply was "No... but you are sometimes cross and intractable." The death of his wife in August 1912 was a severe blow. That she was a constant inspiration to him throughout his life, no one can doubt who has read his letters. The man who could be so tough and so brusque at times was also the man who could write to her in salutation: "Idle of my Sole." He was the same man who could tell stories about Daniel in the Lions' Den to a little girl on a picnic.

During his last years he was frequently unwell. He had had five operations for facial cancer between 1890 and 1892, the last performed by Dr. William S. Halsted and involving a radical neck dissection. He was troubled with renal and biliary calculi; in 1900 he was operated on by Dr. Charles McBurney, and in 1906 a cholecystectomy was performed. In 1913 he underwent another operation, pneumonia supervened, and he died on March 11, in his seventy-fifth year, one week after the inauguration of President Wilson. He was buried in Arlington National Cemetery.

In his seventy-five years, he had fought a war, had revolutionized hospital construction, had been a prime mover in public hygiene and sanitation, had played a leading role in the development of vital statistics, had challenged the medical profession to higher levels of accomplishment, had done more to advance American medical education than any other individual of his generation, had created a great national medical library and built for it bibliographical keys of comparable magnitude. He was a mover and shaker; he had organizing genius and the passion for doing. He had vision, managerial adroitness, and a dogged and relentless power of will. Once he had said to the Librarian of the Royal Society of Medicine: "I'll let you into a secret--there's nothing really difficult if you only begin--some people contemplate a task until it looms so big, it seems impossible, but I just begin and it gets done somehow. There would be no coral islands if the first bug sat down and began to wonder how the job was to be done." [8]

Billings was singularly fortunate in his biographers. Fielding H. Garrison, who had joined the staff of the Surgeon General's Library in 1891, brought out his remarkable memoir in 1915; Harry Miller Lydenberg, Billings' protege and later successor as Director of the New York Public Library, prepared a shorter evaluation in 1924 to inaugurate the ALA series on American

[8] J. Y. W. MacAlister, British Medical Journal 1: 642 (1913).

Library Pioneers. In what follows I borrow many of their words and phrases, adding some emphasis of my own.

Billings was a tall figure of powerful build and commanding appearance. He was austere and somewhat distant in manner, and did not suffer fools gladly; he was a man of imperious judgments, and much inclined to have his own way. He was fertile in ideas, straightforward in expression, and entirely wrapped up in accomplishing whatever he set out to do. (Garrison) He knew what the master word in medicine is, he knew the glory of the day's work, he had the rare gift of industry of the minute. He seized upon essentials, and sometimes left behind some baffling small details that plagued his followers. He was impatient of committees and committee work; in striking out ahead of the crowd, he sometimes lost sight of the fact that those who moved in his wake frequently gained by their efforts at standardization and cooperation, however plodding they might be. He had unshakeable confidence in his own judgment; he formed his own opinions and drew his own deductions. He was constantly drawn on into new directions; rarely did he re-examine the purely technical solutions he devised so readily and well.

Through all his activities, through all periods of his life, stands out, pre-eminent and persistent, his love of books. He read wherever he was and whatever he was doing. At sea or on land, at home or away, in the city or in the country, his book and his cigar were his constant companions. (Lydenberg)

He had a strong temper, usually well under control. As reticent in praise as in reproof, the weight of either was unmistakable when he did express it. The army officer was apparent in countless ways, in what he expected as well as what he did. The medical man and the scientist appeared with equal frequency, in his attitude to life, in the way he faced the great problems of nature, in his scrupulously careful weighing of evidence, in his methods of attacking new problems. (Lydenberg)

William Welch said that John Billings was the wisest man he ever knew. He was that rare thing in modern life, an absolutely reliable man. (Garrison) Loyalty to friends and ideals, wideness of sympathy and vision, tenacity of purpose, ceaseless industry, consideration of others before himself, gentleness combined with firmness--these were the outstanding characteristics of this soldier, scholar, physician, librarian, (Lydenberg) this altogether remarkable man who dominated the American medical scene for almost half a century.

The sources of information on Billings' life are pre-eminently:

Fielding H. Garrison, John Shaw Billings, a Memoir. New York, Putnam, 1915. 432 p. [with a genealogy of the Billings family, the military record of JSB, and a bibliography of the writings of JSB].

Harry Miller Lydenberg, John Shaw Billings; Creator of the National Medical Library and Its Catalogue; First Director of the New York Public Library. Chicago, American Library Association, 1924. 95 p. [American Library Pioneers, I].

National Academy of Sciences. Biographical Memoirs. Washington, 1917. Vol. 8.

"Biographical memoir of John Shaw Billings," by S. Weir Mitchell. pp. 375-83. [Published also in Science 38: 827-33 (Dec. 12, 1913)].

"The scientific work of John Shaw Billings," by Fielding H. Garrison. pp. 385-416.

Fielding H. Garrison, "Billings; a Maker of American Medicine," IN Lectures on the History of Medicine, ... 1926-1932. Philadelphia, W. B. Saunders Company. [Lecture given before Northwestern University Medical School, Chicago, November 8, 1928; and before the Mayo Foundation, Rochester, November 14, 1928].

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pp. 511-30. Memorial meeting in honor of the late Dr. John Shaw Billings, April 25, 1913. [Addresses by Weir Mitchell, Wm. Osler, Wm. H. Welch, Andrew Carnegie, Richard B. Bowker, John L. Cadwalader].

pp. 531-3. Appendix [Letters from Cardinal Farley, Sir Henry Burdett, E. C. Richardson, Helen E. Haines, Cressy L. Wilbur].

pp. 534-5. Minute adopted by the American Library Association at its annual conference at Kaaterskill, New York, June 25, 1913; John Shaw Billings, April 12, 1838-March 11, 1913.

[An account of this meeting appears also in Library Journal 38: 334-8 (June 1913)].

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I. John Shaw Billings and federal vital statistics." Journal of the American Statistical Association 21: 257-66 (1926).

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Introduction. Henry E. Sigerist. pp. 223-4.

John Shaw Billings as an Army medical officer; a tribute on his hundredth birthday, April 12, 1938. Edgar Erskine Hume. pp. 225-70.

John Shaw Billings and the Johns Hopkins Medical School; a tribute on the one hundredth anniversary of his birth. Alan M. Chesney. pp. 271-84.

Two papers by John Shaw Billings on medical education; with a foreword by Alan M. Chesney. pp. 285-359.

John Shaw Billings and the history of medicine. Sanford V. Larkey. pp. 360-76.

John Shaw Billings and the New York Public Library. H. M. Lydenberg. pp. 377-86.

Raymond Pearl, "Some notes on the contribution of Dr. John Shaw Billings to the development of vital statistics." Bulletin of the Institute of the History of Medicine 6: 387-93 (1938).

"Two letters by John Shaw Billings on the history of medicine," with a foreword by Sanford V. Larkey. Bulletin of the Institute of the History of Medicine 6: 394-8 (1938).

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[Sir Henry Burdett], Hospital (London) 53:671-3 (March 22, 1913).

J. Y. W. MacAlister, British Medical Journal 1: 642 (March 22, 1913).

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Sir William Osler, British Medical Journal 1: 641 (March 22, 1913).

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J. Ewing Mears, Transactions of the American Surgical Association 31: xxxiv-xxxix (1913).

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John F. Fulton, The Great Medical Bibliographers; a Study in Humanism. Philadelphia, University of Pennsylvania Press, 1951. ["John Shaw Billings," pp. 67-75].

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Dorothy M. Schullian, "Alfred Alexandar Woodhull, John Shaw Billings, and the Johns Hopkins Hospital, 8 June 1871." Journal of the History of Medicine and Allied Science 13: 531-7 (1958).

Harold W. Jones, "The Army Medical Library; its history and its future obligations." Journal of the American Medical Association 122: 1074-9 (1943).

Richard Hood, "The Army Medical Library." Science 105: 422-6 (April 25, 1947).

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Public Health Service